NAVAIR 00-80T-109

AIRCRAFT REFUELING NATOPS MANUAL

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ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS AND
UNDER THE DIRECTION OF THE COMMANDER,
NAVAL AIR SYSTEMS COMMAND.

DEPARTMENT OF THE NAVY
CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, D.C. 20350-2000

15 June 2002

LETTER OF PROMULGATION

1. The Naval Air Training and Operating Procedures Standardization (NATOPS) Program is a positive approach toward improving combat readiness and achieving a substantial reduction in the aircraft mishap rate. Standardization, based on professional knowledge and experience, provides the basis for development of an efficient and sound operational procedure. The standardization program is not planned to stifle individual initiative, but rather to aid the commanding officer in increasing the unit's combat potential without reducing command prestige or responsibility.

2. This manual standardizes ground and flight procedures but does not include tactical doctrine. Compliance with the stipulated manual requirements and procedures is mandatory except as authorized herein. In order to remain effective, NATOPS must be dynamic and stimulate rather than suppress individual thinking. Since aviation is a continuing, progressive profession, it is both desirable and necessary that new ideas and new techniques be expeditiously evaluated and incorporated if proven to be sound. To this end, commanding officers of aviation units are authorized to modify procedures contained herein, in accordance with the waiver provisions established by OPNAVINST 3710.7, for the purpose of assessing new ideas prior to initiating recommendations for permanent changes. This manual is prepared and kept current by the users in order to achieve maximum readiness and safety in the most efficient and economical manner. Should conflict exist between the training and operating procedures found in this manual and those found in other publications, this manual will govern.

3. Checklists and other pertinent extracts from this publication necessary to normal operations and training should be made and carried for use in naval aircraft.

M.J. McCABE
Rear Admiral, U.S. Navy
Director, Air Warfare

INTERIM CHANGE SUMMARY

The following Interim Changes have been cancelled or previously incorporated into this manual.

INTERIM CHANGE NUMBER(S)	REMARKS/PURPOSE
1–2	Previously incorporated.

The following Interim Changes have been incorporated into this Change/Revision.

INTERIM CHANGE NUMBER(S)	REMARKS/PURPOSE
3	Formal training requirements and syllabus for Aviation Fuels Division Continuing Training.
4	Requirements for Aircraft Handling Officer Approval.

Interim Changes Outstanding — To be maintained by the custodian of this manual.

INTERIM CHANGE NUMBER	ORIGINATOR/DATE (or DATE/TIME GROUP)	PAGES AFFECTED	REMARKS/PURPOSE

Summary of Applicable Technical Directives

Information relating to the following recent technical directives has been incorporated into this manual.

CHANGE NUMBER	DESCRIPTION	DATE INC. IN MANUAL	VISUAL IDENTIFICATION

Information relating to the following applicable technical directives will be incorporated in a future change.

CHANGE NUMBER	DESCRIPTION	DATE INC. IN MANUAL	VISUAL IDENTIFICATION

RECORD OF CHANGES

Change No. and Date of Change	Date of Entry	Page Count Verified by (Signature)

Aircraft Refueling NATOPS Manual

Contents

Page No.

Page No.

CHAPTER 5 — SHIPBOARD AIRCRAFT REFUELING SYSTEM AND EQUIPMENT

CHAPTER 6 — SHIPBOARD OPERATING PROCEDURES

CHAPTER 7 — SHIPBOARD PREVENTION MAINTENANCE

CHAPTER 8 — ORGANIZATION AND TRAINING AT SHORE ACTIVITIES

Page No.

CHAPTER 9 — QUALITY SURVEILLANCE OF AVIATION FUELS AT SHORE ACTIVITIES

Page No.

CHAPTER 10 — SAFETY IN SHORE ACTIVITY FUEL HANDLING OPERATIONS

CHAPTER 11 — SHORE ACTIVITY FACILITIES AND EQUIPMENT

CHAPTER 12 — OPERATING PROCEDURES FOR SHORE ACTIVITIES

Page No.

CHAPTER 13 — MAINTENANCE OF REFUELING FACILITIES AT SHORE ACTIVITIES

Page No.

CHAPTER 16 — SAFETY IN TACTICAL FUEL HANDLING OPERATIONS

CHAPTER 17 — TACTICAL FUEL SYSTEMS AND EQUIPMENT

Page No.

Page No.

List of Illustrations

Page No.

CHAPTER 5 — SHIPBOARD AIRCRAFT REFUELING SYSTEM AND EQUIPMENT

CHAPTER 6 — SHIPBOARD OPERATING PROCEDURES

CHAPTER 8 — ORGANIZATION AND TRAINING AT SHORE ACTIVITIES

CHAPTER 11 — SHORE ACTIVITY FACILITIES AND EQUIPMENT

CHAPTER 12 — OPERATING PROCEDURES FOR SHORE ACTIVITIES

Page No.

CHAPTER 13 — MAINTENANCE OF REFUELING FACILITIES AT SHORE ACTIVITIES

CHAPTER 17 — TACTICAL FUEL SYSTEMS AND EQUIPMENT

CHAPTER 18 — OPERATING PROCEDURES FOR TACTICAL FUEL UNITS

APPENDIX A — AVIATION FUEL QUALITY SURVEILLANCE LOGS AND LABELS

GLOSSARY

This glossary consists primarily of commonly used acronyms. Since many words are defined within the text of this NATOPS manual, please refer to the index for words and terms not found below. In addition, Appendix D of MIL-HDBK-844(AS) contains a more extensive glossary of aircraft refueling terms.

A

AAFS. Amphibious assault fuel system.

ABF. Aviation boatswain's mate fuels.

ABFC-H14K. Advanced base functional components fueling systems.

ABFCFS. Advanced base functional component fueling systems.

ACHO. Aircraft Handling Officer (shipboard operations).

AFMO. Assistant Fuel Management Officer at a Navy shore station.

AFOSS. Aviation Fuel Operational Sequencing Systems. The set of detailed instructions that cover the operation of shipboard aviation fuel systems.

ALF. Auxilary landing field.

ANSI. American National Standards Institute.

API. American Petroleum Institute.

APU. Auxillary power unit — a small turbine engine on an aircraft that provides power when the main engine(s) is not operating. Also see GTC and GTS.

ASME. American Society of Mechanical Engineers.

ASTM. American Society for Testing and Materials.

AVGAS. Aviation gasoline.

B

B/2 Anti-icing Test Kit. Fuel test kit that contains an instrument to measure the FSII content of the fuel.

B/2 Refractometer. Instrument used to measure the FSII content on fuel.

Bonding. The act of providing an electrical connection between two objects; i.e., an aircraft and a refueling truck.

BUNO. Bureau number — number designation assigned to each aircraft.

C

CCFD. Combined contaminated fuel detector — device used to test fuel for both water and particulate contamination.

CCR. Closed circuit refueling — nozzle and receptacle system used on US Army helicopters.

CFD. Contaminated fuel detector — device that can be used to tests fuel for particulate contamination.

CFR. Crash, fire, rescue.

CNO. Chief of Naval Operations.

CO. Commanding Officer.

CONFLAG stations. Conflagration stations — Shipboard locations where firefighting equipment controls are installed.

COR. Contracting Officer's Representative.

CV. Aircraft carrier.

CVN. Aircraft carrier, nuclear powered.

D

D-1. SPR aircraft refueling nozzle with a 45-degree elbow.

D-1R. SPR aircraft refueling nozzle with a 45-degree elbow and a hose end pressure regulator.

D-2. SPR aircraft refueling nozzle with straight body.

D-2R. SPR aircraft refueling nozzle with straight body and a hose end pressure regulator.

Deadman control. A device that governs (controls) the primary pressure/flow valve in a refueling system. The valve opens only when an operator applies pressure to the handle, trigger, etc. If pressure is removed, the valve closes and fuel flow stops.

DEFCON. Defense condition.

Defueling. Removing fuel from an aircraft.

Deterioration Use Limits. The minimum physical and chemical property requirements for fuel to be used in an aircraft.

DFSC. Defense Fuel Supply Center.

DiEGME. DiEthylene Mono Methyl Ether. FSII used in military aviation turbine fuels.

DLA. Defense Logistics Agency.

DOD. Department of Defense.

E

Earthing. The act of providing an electrical connection between an object (e.g., aircraft) and the Earth (or ground).

EOOW. Shipboard term for Engineer Officer of the Watch.

EPA. Environmental Protection Agency.

F

F-76. Shipboard Distillate Fuel (used in diesel and ship turbine engines).

FAA. Federal Aviation Administration.

FARP. Forward arming and refueling point.

FAS. Fueling at-sea station.

FC. Fuels Chief. Marine Corp term for the assistant fuels officer. Equivalent to the AFMO at a Navy shore station.

FFG. Guided missile frigates.

Flushing. Another term applied to recirculation.

FMF. Fleet Marine Force.

FMO. Fuel Maintenance Officer on ships and Fuel Management Officer at Navy shore stations. The title assigned to the full-time functional head of integrated fuel operations at an activity.

FO. Fuels Officer. Marine Corp term of the fuels commodity manager and/or the functional head of a fuels organization. Equivalent to an FMO at a Navy shore station.

FOB. Forward operating base.

FOD. Foreign object damage.

FOR. Fuel oil reclaimed.

Free Water Standard. A color intensity comparator standard used in the FWD for determining the free water content of fuel.

FSII. Fuel system icing inhibitor. A fuel additive that prevents formation of water ice and microbiological growth in the fuel.

FSSG. Force service support group.

FWD. Free-water detector — device that measures the free-water content of a fuel sample.

G

Gammon Fitting. Common name applied to the jet test QD (quick disconnect) couplings used in refueling nozzles and other places to take fuel samples.

Grounding. The act of providing an electrical connection between an object (e.g., aircraft) and the ground (Earth).

GSO. General specifications for overhaul.

GTC. Gas turbine compressor. An onboard aircraft starting system also refered to as a GTS.

GTS. Gas turbine starter. An onboard aircraft starting system.

H

HECV. Hose end control valve (same as HEPR).

HEPR. Hose end pressure regulator. Device that limits its fuel pressure entering the aircraft to a set maximum.

HERS. Helicopter expedient refueling system.

HIFR. Helicopter in-flight refueling. Refueling a helicopter from a ship while it hovers over the deck.

I

ITSS. (Marine Corps) Individual Training Standards System.

L

LHA. Amphibious assault ship.

Line NCO. Line noncommissioned officer.

LOX. Liquid oxygen.

LPD. Amphibious transport dock ship.

M

M970. Semitrailer, tank, 5,000-gallon fuel dispensing, under/overwing aircraft nozzles.

MFVU. Mobile firefighting vehicle/unit.

MILCON. Military construction.

MOGAS. Automotive gasoline.

MOS. Military occupational speciality.

N

NAVAIR. Naval Air Systems Command.

NAVFAC. Naval Facilities Engineering Command.

NAVFACENGCOM. Naval Facilities Engineering Command.

NAVPETOFF. Navy Petroleum Office.

NHC. NATO high-capacity HIFR rig.

NI. North Island HIFR rig. The original Wiggins HIFR rig.

NSTM. Naval Ships Technical Manual.

O

OJT. On the job training.

OLF. Outlying landing field.

OSHA. Occupational Safety and Health Administration.

OSS. Operational Sequencing System. The set of detailed instructions that cover the operation of shipboard fuel systems.

P

Pantograph. A device used at shore stations to refuel aircraft. It is composed of a series of pieces of pipe, supported by rollers, and connected by swivel joints. One end of the device is connected to a fuel source while the other end has a short hose with an aircraft refueling nozzle attached.

PKP. A dry chemical fire extinguisher containing potassium bicarbonate.

PM. Preventive maintenance.

PMS. Planned Maintenance System.

POL. Petroleum, oil, and lubricants.

PQS. Personnel Qualification Standard.

PriFly. Primary flight control (shipboard operations).

PWO. Public Works Officer.

Q

QAR. Quality assurance representative. A DLA employee who observes the sampling and testing of fuel at the time of acceptance by the US government.

QDC. Quick disconnect coupling.

Quality Assurance. Fuel quality control measures (sampling and testing) that are performed on the fuel at the refinery.

Quality Surveillance. Fuel quality control efforts (sampling and testing) that are performed on the fuel from the time it leaves the refinery until it is consumed by an aircraft.

R

Ready Issue Fuel. Aviation fuel in the retail system of a shore activity.

Ready Issue Fuel System. The fuel handling and filtration systems that process and load the fuel into the aircraft. The system includes short-term storage tanks (normally 10-day supply for the activity), filter/separators, monitors, relaxation chambers, truck fill stands, direct refueling stations, associated plumbing and hardware, refueling trucks, etc.

Recirculation. The operation of a fuel system where fuel is pumped from a tank through a filter/separator and back into the tank. The action serves two purposes — it flushes out the lines downstream of the filter/separator with clean/dry fuel and cleans up the fuel in the tank.

Refueling. Loading fuel onto an aircraft.

Retail Fuel. Aviation fuel in a tank or mobile refueler that can be issued to an aircraft.

S

Safed. The replacement of any mechanical arming level, safety pin, electrical interrupt plug/pin, securing of armament switches, and/or any appropriate action that renders the particular ordnance carried as safe.

Service Fuel. Shipboard term for fuel that has been filtered (or purified by a centrifugal) purifier, and transferred to a tank where it will be pumped to an aircraft.

SIB. Ship's information book.

SIMA. Ships Intermediate Maintenance Activity.

SPR. Single-point pressure refueling. Pressure refueling an aircraft through a single connection.

STANAG. North Atlantic Treaty Organization (NATO) Standardization Agreement.

SYSCOM. System Commander.

T

T.O. Technical order (USAF equivalent of NATOPS Manual).

T/O. Table of Organization.

TAD. Temporary additional duty.

TAFDS. Tactical airfield fuel dispensing system.

TAU. Twin agent unit. A fire extinguisher that expels two different firefighting materials at the same time.

TM. Technical manual.

TYCOM. Type Commander.

U

USA. United States Army.

USAF. United States Air Force.

USCG. United States Coast Guard.

USMC. United States Marine Corps.

USN. United States Navy.

PREFACE

SCOPE

The Aircraft Refueling Naval Air Training and Operating Procedures Standardization Program (NATOPS) Manual is issued by the authority of the Chief of Naval Operations (CNO) in conjunction with the NATOPS Program. This manual covers the technical requirements, operational procedures, and personnel training for ready-issue (retail) aviation fuel operations. Ready-issue fuel operations include fuel receipt, short-term storage (usually a 10-day supply of fuel for the specific activity), transfer, and dispensing to aircraft. This manual provides the best available operating instructions for most circumstances, but no manual is a substitute for sound judgement. The local fuel maintenance officer (FMO) on ships or fuel management officer at shore activities must rely on knowledge and experience in the application of these requirements and procedures to the local situation. Operational necessity (as defined by OPNAVINST 3710.7 series) may require modification of the procedures contained herein.

HOW TO GET COPIES

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UPDATING THE MANUAL

To ensure that the manual contains the latest procedures and information, NATOPS review conferences are held in accordance with OPNAVINST 3710.7 series.

CHANGE RECOMMENDATIONS

Recommended changes to this manual or other NATOPS publications may be submitted by anyone in accordance with Appendix A OPNAVINST 3710.7 series.

Change recommendations should be submitted directly to the model manager on OPNAV Form 3710/6 shown on the next page. When submitting routine changes, ensure only one change recommendation is contained on each form. The address of the model manager of this manual is:

Commander
Naval Air Systems Command (AIR-4.4.5)
22229 Elmer Road, Unit 4
Patuxent River, MD 20670

NATOPS/TACTICAL CHANGE RECOMMENDATION
OPNAV 3710/6 (4-90) S/N 0107-LF-009-7900 **DATE** _____

TO BE FILLED IN BY ORIGINATOR AND FORWARDED TO MODEL MANAGER

FROM (Originator)	Unit
TO (Model Manager)	Unit

Complete Name of Manual/Checklist	Revision Date	Change Date	Section/Chapter	Page	Paragraph

Recommendation (Be specific.)

☐ CHECK IF CONTINUED ON BACK

Justification

Signature	Rank	Title

Address of Unit or Command

TO BE FILLED IN BY MODEL MANAGER *(Return to Originator)*

FROM	DATE
TO	

REFERENCE

(a) Your Change Recommendation Dated _____

☐ Your change recommendation dated _____ is acknowledged. It will be held for action of the review conference planned for _____ to be held at _____

☐ Your change recommendation is reclassified URGENT and forwarded for approval to _____ by my DTG _____

/S/ _____ MODEL MANAGER	_____ AIRCRAFT

For items concerning afloat systems and procedures, provide information copy to:

Commander
Naval Sea Systems Command
SEA-03L
2531 Jefferson Davis Highway
Arlington, VA 22242-5160
(Amphibious/air-capable ship fuel reports only)

Participation of the individual in this program of continual manual improvement is imperative. Procedures relative to change recommendations are specified in OPNAVINST 3710.7.

All urgent change recommendations shall be sent by priority message to the advisory group member in the chain of command using the message format shown in OPNAVINST 3710.7. Commander, Naval Air Systems Command (COMNAVAIRSYSCOM) and Naval Safety Center (NAVSAFECEN) shall also be included as action addresses.

RESPONSIBILITY

NATOPS manuals are kept current through an active manual change program. Any corrections, additions, or constructive suggestions for improvement of its content should be submitted by routine or urgent change recommendation, as appropriate at once.

NATOPS MANUAL INTERIM CHANGES

Interim changes are changes or corrections to the NATOPS manuals promulgated by CNO. Interim changes are issued either as printed pages, or as a naval message. The interim change summary page is provided as a record of all interim changes. Upon receipt of a change or revision, the custodian of the manual should check the updated interim change summary to ascertain that all outstanding interim changes have been either incorporated or canceled; those not incorporated shall be recorded as outstanding in the section provided.

CHANGE SYMBOLS

Revised text is indicated by a black vertical line in either margin of the page, adjacent to the affected text, like the one printed next to this paragraph. The change symbol identifies the addition of either new information, a changed procedure, the correction of an error, or a rephrasing of the previous material.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to "WARNINGs," "CAUTIONs," and "Notes" found throughout the manual.

WARNING

An operating procedure, practice, or condition, etc., which, if not strictly observed, may damage equipment.

CAUTION

An operating procedure, practice, or condition, etc., that may result in damage to equipment, if not carefully observed or followed.

Note

An operating procedure, practice, or condition, etc., that is essential to emphasize.

WORDING

The concept of word usage and intended meaning adhered to in preparing this manual is as follows:

"Shall" has been used only when application of a procedure is mandatory.

"Should" has been used only when application of a procedure is recommended.

"May" and "need not" have been used only when application of a procedure is optional.

"Will" has been used only to indicate futurity, never to indicate any degree of requirement for application of a procedure.

CHAPTER 1

Introduction

1.1 SCOPE AND PURPOSE

This manual covers the technical requirements, operational procedures and personnel training for ready-issue (retail) aviation fuel operations. Ready-issue fuel operations include fuel receipt, short-term storage (usually a 10-day supply of fuel for the specific activity), transfer, and dispensing to aircraft. This manual provides the best available operating instructions for most circumstances, but no manual is a substitute for sound judgment. The local FMO (Fuel Maintenance Officer on ships or Fuel Management Officer at shore activities) must rely on his/her knowledge and experience in the application of these requirements and procedures to the local situation. Operational necessity (as defined by OPNAVINST 3710.7 series) may require modification of the procedures contained herein.

1.2 RESPONSIBILITY

The commanding officer of each ship or Navy and Marine Corps activity has complete responsibility for aviation fuels aboard his/her ship, main activity and all outlying sites including OLFs, ALFs, helicopter landing areas, etc., from receipt to issue into aircraft tanks.

Inherent in the responsibility for fuel are such items as accountability, quality control, safety, handling practices, personnel qualifications, and operational and corrective maintenance of facilities and equipment.

Since the aviation fuel facilities and handling equipment vary significantly from ship to ship and shore activity to shore activity, the instructions and procedures contained in this manual are necessarily broad and do not cover all aspects of every activity's operation in detail. Local activities, therefore, must supplement this manual with local fuel instructions to clarify fuel related responsibilities and procedures peculiar to their activities and their respective facilities/equipment. For ships, the majority of this task is covered by the Aviation Fuel Operational Sequencing Systems (AFOSS) Manual.

To clarify fuel-related responsibilities, each activity shall maintain an up-to-date fuel handling instruction that supplements this manual and constitutes the activity's authoritative governing document for fuel operations. This manual may be cross-referenced within the local instruction as necessary. Local practices in direct conflict with the broad base of instruction in this manual must be approved by the Naval Air Systems Command, AIR-4.4.5, and reviewed by the Naval Sea Systems Command, SEA-03L (afloat concerns only). Coverage in the local instruction shall include but not necessarily be limited to the following:

1. Fuel organization with functional assignments and duties in detail.

2. Inter- and intra-departmental responsibilities for fuel, fuel facilities, fuel equipment, and fuel spills.

3. Amplification of this manual's general terms and safety precautions where coverage is too broad for the local situation.

4. Detailed and specific procedures for any unique or peculiar system including any aircraft that requires non-standard handling, and for any approved procedures or practices that are in conflict with this manual.

5. Environmental impact and duties associated therewith.

The Naval Sea Systems Command, SEA-03L, is the life-cycle cost manager for shipboard aircraft refueling systems. Questions, problems, and concerns regarding the technical requirements for the systems or their operation and maintenance should be directed to this office for resolution.

1.3 ADVISORY GROUP

In addition to the advisory group members listed in the current edition of 3710.7, the following are advisory group members for this manual:

Commander, Naval Surface Force, U.S. Atlantic Fleet

Commander, Naval Surface Force, U.S. Pacific Fleet

Commander, Marine Corps Systems Command

Commanding Officer, Marine Corps Energy Office

Commanding General, Marine Forces Reserve

Commander, Naval Sea Systems Command

Commander, Naval Facilities Engineering Command

Commanding Officer, Navy Petroleum Office.

1.4 WAIVERS

The procedure for requesting waivers to the provisions of this manual are found in the current revision of OPNAVINST 3710.7 (series). Information copies of waiver requests shall be forwarded to the following agencies as indicated below:

1. All waiver requests — COMNAVAIRSYSCOM (AIR-4.4.5)
2. Shipboard waivers — COMNAVSEASYSCOM (PMS-312V; SEA 03L)
3. Air Station waivers — Naval Petroleum Office
4. Tactical refueling waivers — Marine Corps Energy Office.

CHAPTER 2

Organization and Training Aboard Ships

2.1 ORGANIZATION

The effectiveness of any complex operation is dependent on a well-structured organization with qualified and knowledgeable supervision. The cost of fuel, fuel facilities and equipment, and hazards of fuel operations are a few of the critical factors that shall be considered in the development of a fuel organization. It is these factors, coupled with the essential part aircraft refueling plays in flight operations, that justifies "Division" status for the integrated fuel operation.

On aircraft carriers and amphibious assault aviation ships the air officer is responsible to the ship's commanding officer for supervising and directing the receipt, stowage, and dispensing of aviation fuels as well as the maintenance and security of the aviation fuels systems and the enforcement of safety precautions. These duties are actually administered by the aviation fuels officer — it is his/her responsibility to ensure compliance with all applicable technical directives concerning the inspection, maintenance, and operation of the aviation fuel system. The deck officer is responsible for the fueling at sea (FAS) stations, and the supply officer is responsible for the accountability of the fuel.

The air operations officer, in conjunction with the air department officer/aircraft handling officer, is responsible for establishing priorities for aircraft fuel delivery services.

On air-capable ships, the ship's engineer is responsible to the ship's commanding officer for the aviation fuel system, its maintenance, and operation. Since the system is small and generally services only one helicopter, many of the specific duties are combined and performed by two or three individuals. Nonetheless, air-capable ships must fully comply with all fuel quality surveillance, operational, and maintenance procedures presented in this manual.

2.2 TRAINING REQUIREMENTS

All operations involving the JP-5 system shall be conducted by operators qualified in accordance with the Air Department Aviation Fuels Afloat Personnel Qualification Standard (PQS) NAVEDTRA 43426.4 (series) or for Aviation Fuels Air Capable Ships, less LPD, PQS NAVEDTRA 43149. Aviation Boatswain's Mate Fuels Rating training courses and rating requirements provide shipboard personnel with the skills and knowledge neccessary for shipboard fuel handling duties.

2.2.1 Formal Training. Formal training oriented to each ships installed systems equipment, is available through NAMTRAGUDET/MTU 3040 (9287 7th Ave, Norfolk, VA) and NAMTRAGUDET/MTU 3041 (NAS North Island, Box 357059, San Diego, CA) in the form of an aviation fuels mobile training team. NAMTRAGRUDET/MTUS 3040/3041 are organized to provide training at the ships homeport/homeyard and should be utilized to the maximum extent possible between ships deployments and during repair availabilities.

1. EOSS/AFOSS manuals may be used as a training aid.

2. Training shall be held in firefighting procedures with particular emphasis on aviation fuel, JP-5 pumproom, flight and hangar deck fires.

3. Due to the unique hazards involving aviation fuels handling, a continuous training program in support of PQS shall be implemented in each ship. Guidance on establishing a continuous training program is available from the appropriate TYCOMs. Appendix C contains a list of subjects which should be part of a ships aviation fuel division continuous training syllabus.

CHAPTER 3

Quality Surveillance of Aviation Fuels Aboard Ships

3.1 GENERAL REQUIREMENTS

The major objective of fuel handling personnel is to deliver clean, clear, and bright fuel to aircraft. The fuel systems of modern aircraft are complex and will not function properly if fuel is contaminated with dirt, water, or other foreign matter. In addition, aircraft engine failure or poor performance may also be caused by incorrect fuel or by contamination of the proper fuel with other petroleum products or materials. Refer to the NAVAIR Aircraft Refueling Handbook (MIL-HDBK-844(AS)) for a detailed discussion of the various types of fuel contaminants, their effects on the using equipment, and their possible sources.

The quality surveillance of aviation fuels is a continuous process. Every action such as transferring product from one tank to another or short-term storage in a poorly coated tank can introduce contaminants into the fuel. Therefore, local operating procedures shall be written with this fact in mind. Sources of contamination must be recognized and eliminated or at least minimized. In addition, procedures to routinely monitor the quality of fuel must be in place so that the presence of abnormal amounts of contaminants is identified and steps to remove the contaminants are taken.

The Defense Logistics Agency and its field activity, the Defense Fuel Supply Center, have designated the fuel quality control efforts performed at the refinery or time of fuel purchase as "quality assurance." All fuel quality control efforts performed after the fuel has been delivered to the government are classified as "quality surveillance." This chapter conforms to this policy.

This chapter outlines the absolute minimum steps that shall be taken in order to:

1. Monitor the quality of the fuel being handled and delivered to aircraft.
2. Control and minimize the introduction of typical contaminants (water and particulates).

The detailed operating procedures contained in Chapter 6 and the maintenance procedures referred to in Chapter 7 incorporate many of these monitoring and quality surveillance steps. Any local operating instructions for specific systems or pieces of equipment shall also contain appropriate quality surveillance procedures.

3.2 SHIPBOARD AVIATION FUEL QUALITY SURVEILLANCE PROGRAM

All aircraft refueling activities shall establish a formal fuel quality surveillance program. Samples shall be taken from various points in the fuel system such as stripping pumps, purifiers, filter/separators, refueling nozzles, etc., and tested using the combined contaminated fuel detector (CCFD) and free-water detector (FWD). Visual inspections shall also be performed for spot checks. A fuel sample log shall be maintained per Figure A-6; correlation sample logs shall be maintained per Figures A-3 and A-4.

The following paragraphs establish the minimum sampling and testing requirements for aviation fuels. These requirements are the minimum and shall not preclude more frequent or extensive testing should contamination be suspected. The Naval Ship's Technical Manual, Chapter 542, Naval Ship's Technical Manual S9542-AA-MM0-010 and planned maintenance system (PMS), in addition to the appropriate ship's operational sequencing system (OSS) and the Ships Information Book (SIB) shall be consulted for detailed information on handling and sampling aviation fuels aboard ships.

3.2.1 Fuel Received by Ships that Fuel Aircraft.

After flow has been established to the receiving ship, a line sample will be taken and checked for:

1. Color
2. Appearance.

Continue to receive if the product is clear and bright. Immediately take a second sample and test for:

1. API gravity
2. Flash point
3. Particulates
4. Fuel system icing inhibior (FSII)
5. Water.

Visual samples shall be taken every 15 minutes and inspected for color and appearance. At a minimum, lab samples shall be taken at the beginning, mid-point, and just prior to completion of product transfer.

3.2.2 Fuel Dispensed to Aircraft by Ships. Aircraft refueling nozzles shall be flushed with service fuel (including helicopter in-flight refueling (HIFR) systems) back to the ship's JP-5 storage tanks until clear and bright sample is obtained, prior to initiating the first aircraft refueling of each day from that specific refueling station. Flushing shall be accomplished daily when underway. Fuel samples shall be taken at the refueling nozzle and tested for:

1. Appearance
2. Particulates
3. Free water
4. FSII content (spot checks only).

Note

A minimum of two samples is required when running both a CCFD and a FWD test (one for each test) to ensure correct quantity of fuel is available to run both tests. Fuel tested for particulates, free water, or FSII shall not be reused to run any other test since this practice could lead to inaccurate results.

Flushing shall be continued until test results are consistent or results indicate compliance with the use limit requirements. Additional visual and laboratory samples will then be taken throughout the day and inspected for appearance, visible free water, or sediment (particulates).

Ships' force shall test samples for FSII content upon receipt of fuel from fleet oiler, tanker, or barge, and shall also conduct spot checks at refueling nozzles. The Navy's fuel supply/delivery system can significantly reduce FSII levels by exposure of the fuel to water. Whenever low FSII fuel is encountered, it will be necessary to increase the monitoring of the fuel issued to aircraft (see paragraph 3.5.5). FSII concentrations in fuel shall be determined using the B/2 Anti-Icing Additive Test Kit.

3.2.3 Routine Correlation Samples and Tests. Each activity shall take a series of routine, duplicate correlation samples to verify that in-house testing procedures and equipment are working properly. The results from this sampling/testing program are used by the Type Commanders (TYCOMs) and System Commanders (SYSCOMs) to monitor the general quality of fuel loaded into aircraft.

The exact number of routine duplicate correlation samples drawn, shipped, and tested by each ship depends upon the number of CCFDs and B/2 anti-icing refractometers the activity possesses. As an absolute minimum, each activity shall draw one set of duplicate samples (two 1-quart bottles) for each CCFD and one set (two 1-quart bottles) for each B/2 anti-icing refractometer. Take and process each duplicate set of samples as follows:

1. Randomly select an aircraft refueling station and delivery hose.
2. Extract two 1-quart samples, one immediately after the other, from the refueling nozzle of the system while it is being recirculated or flushed.
3. Take both samples back to the activity's laboratory.

Note

If more than one set of duplicate samples is being taken at one time, appropriate steps must be taken to ensure the source of each set of samples can be positively identified.

4. Test one of the samples, using either the CCFD or B/2, and record the results in a log (see Figures A-2 and A-3).
5. Complete a fuel sample label (see Figure A-4) and attach it to the second (duplicate) sample. The results obtained using the CCFD or B/2 shall be entered on this label.

6. Ship the labeled, second (duplicate) sample to a regional fuel testing laboratory (see Appendix B of the MIL-HDBK-844(AS) for a list of laboratories) for testing of the particulates (using the ASTM D 2276 gravimetric method) or FSII as indicated on the sample's label.

7. When results from the regional laboratory are received, enter them into the appropriate log next to the result obtained using the activity's CCFD or B/2 Test Kit. Compare the two results on the duplicate samples to verify the accuracy of the CCFD or B/2 Test Kit.

3.3 SAMPLING PROCEDURES

Proper sampling of petroleum products is as important to quality surveillance as proper testing. Improper containers and poorly-drawn or mishandled samples can cause laboratory results to be meaningless, or worse, misleading.

Directions for sampling cannot be made explicit enough to cover all cases. Judgment, skill, and experience should supplement any group of instructions. Consequently, the person assigned to take samples shall be trained, experienced, competent, and conscientious. The responsibility for taking and preparing samples shall not be lightly delegated.

This section provides general information on petroleum sampling techniques and practices. For more detailed information and instructions including descriptions of the various types of samples (for example, all-levels, bottom, composite, etc.) consult ASTM Standard Practice D-4057.

3.3.1 General Rules

1. The sampler's hands shall be clean.

2. Sample containers, clear glass quart bottles or LDPE/HDPE plastic bottles, shall be meticulously cleaned (washed with an appropriate laboratory detergent). Wipe bottles clean with lint-free cloths (i.e., MIL-C-85043 Type II).

Note

Alcohol shall not be used to clean sample bottles.

3. Samples shall be representative of the product being sampled. Samples shall be taken with the system operating at normal flow rates and steady state. Samples drawn during static (no flow) conditions are not representative of the full fuel flow and will give false results.

4. Samples shall be capped promptly, protected from light, and handled expeditiously.

5. Samples taken for shipment to shore laboratories shall be taken only in 1-quart glass sample bottles. Glass sample bottles for shipment to shore laboratories shall be filled to 1 inch below the cap.

6. LDPE/HDPE plastic bottles are authorized for use for the collection of particulate and free water fuel samples.

7. LDPE/HDPE plastic bottles shall be marked for the appropriate level (800 ml or 500 ml) and filled only to this mark.

8. Samples taken to test filter/separator efficiency shall be taken at the filter discharge.

9. Visual samples shall be taken in clear glass bottles only.

3.3.2 Sample Containers. The following fuel sampling bottles, containers, kits and safety cans are available through the supply system and are the only type authorized for the collection, retention, and submission of aviation fuel samples.

1. Kit, Fuel Sampling. A complete kit consisting of metal shipping container, cushioning material (inner-pack), and four 1-quart sample bottles, NSN 8115-00-719-4111.

2. Cushioning Material. Replacement top/bottom packing material for the above fuel sampling kit, NSN 8115-00-719-4825.

3. Replacement Kit. Replacement bottles and tags for the above fuel sampling kit, NSN 8115-00-717-8572.

4. Container, Fuel Sample. A 1-gallon, 24-gauge steel, epoxy resin lined fuel sample can suitable for the shipment or retention of fuel samples, NSN 8110-00-128-6819.

5. Drum, Shipping and Storage. A 5-gallon, 24-gauge steel, epoxy-lined fuel sample container suitable for shipment or retention of fuel samples, NSN 8110-00-400-5748.

6. Bottles, Glass, Clear. Six 1-quart clear glass bottles (without tags) suitable for taking visual samples and for shipping fuel samples to shore laboratories, NSN 8125-00-378-9994.

7. Bottles, LDPE/HDPE Plastic. Plastic bottles suitable for taking particulate and free water samples are available in two sizes:

   a. 1000 ml, NSN 6640-01-300-3541 (6 bottles)

   b. 500 ml, NSN 6640-01-461-1016 (12 bottles)

8. Container, Safety Can. Containers for the safe storage and transport of used fuel are available in two sizes:

   a. 1 gallon, NSN 7240-00-177-4999

   b. 5 gallon, NSN 7240-00-178-8286

3.3.3 Identification of Sample. All samples sent to a fuel testing laboratory shall be individually tagged with a label (see Figure A-4) containing the following minimum information:

1. The originating ship's name, address, and type (CV/CVN, LHA, LPD, FFG, etc.); a point of contact and phone number should be included (if possible).

2. Sample serial number (sampling activity's designation assigned to this particular sample)

3. Type fuel

4. Date sample was taken

5. Approximate time the sample was taken

6. The source of the sampling point (nozzle sample, filter/separator number, or tank number)

7. Name of the person who drew the sample

8. Classification of sample and tests required (see paragraph 3.3.4).

   a. ROUTINE Correlation (insert CCFD or B/2 results in space provided).

   or

   b. SPECIAL (list tests required and/or pertinent remarks. This is especially important when sending in special samples. The comments will assist the laboratory personnel in determining additional tests that should be performed).

3.3.4 Sample Classification. All samples shipped to a fuel testing laboratory shall be classified either ROUTINE Correlation or SPECIAL.

3.3.4.1 Routine Correlation Sample. Routine correlation samples are the samples taken when no fuel problems or aircraft problems attributable to fuel are known or suspected (see paragraph 3.2.3). These samples and their test results serve two purposes:

1. Assist the activity in monitoring the performance of their local fuel testing equipment and methods.

2. Provide TYCOM and SYSCOM cognizant offices with information on the general quality of the fuel delivered to aircraft and the performance of the fleet's quality surveillance equipment (CCFDs and B/2s).

At a minimum, routine correlation samples will be taken and hand delivered to the shore laboratory prior to departure on extended deployment. However, this does not preclude sending correlation samples more frequently if concerns regarding the results obtained with shipboard QA equipment arise.

3.3.4.2 Special Sample. Special samples are submitted for test because the quality of the fuel is suspect either as the result of aircraft malfunctions or for other reasons.

1. Special samples shall have the highest priority in handling, testing, and shipping.

2. Ships submitting special samples shall notify (via message traffic) TYCOMs and the laboratory to which the sample is being sent.

3.3.5 Shipping Instructions. Samples are to be forwarded to appropriate testing laboratories by the most expeditious means. A listing of military petroleum laboratories is included in MIL-HDBK-844(AS).

Wherever feasible, samples shall be delivered directly to the laboratory by special courier.

Samples to be shipped by military aircraft shall be packed in accordance with the requirements of the manual on Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft (AFM 7l-4/TM 38-250/NAVWEPS 15-03-500/MCO P4030.19). The sampling kit listed in paragraph 3.3.2 above meets these requirements.

WARNING

New sample bottle caps shall be used for all samples being shipped in this sample kit.

3.4 FUEL LABORATORY, TEST EQUIPMENT, AND METHODS

3.4.1 Laboratory. Each activity that refuels aircraft shall have a designated laboratory where the in-house inspections and tests can be performed in a clean, safe environment that meets Naval Ships Technical Manual (NSTM) and General Specifications for Overhaul (GSO). As an absolute minimum, the laboratory must have a properly ventilated fireproof hood in which the test equipment can be permanently set up and operated. The only exception to this requirement is on older, small air capable ships. For these ships, a specific area with good ventilation where the testing equipment can be stored and conveniently set up and operated on a moment's notice must be designated.

3.4.2 Testing Equipment. Each activity that refuels aircraft shall maintain a laboratory with the following equipment:

1. Combined Contaminated Fuel Detector (CCFD). This instrument is used to analyze the particulate contamination in a sample of fuel. Currently, the only CFD being procured is the Combined Contaminated Fuel Detector (CCFD), NSN 6640-01-013-5279, which includes a built-in FWD Viewer Kit. The regular CFD, NSN 6630-00-706-2302, is still available and may be used; kits are available to convert to a CCFD by adding a FWD portion as part of an upgrade/repair. Additional materials needed to conduct tests are:

   a. Filter Element, Fluid, 0.65 micron — NSN 6630-00-877-3157

   b. Filter, Wratten — NSN 6630-00-849-5288.

Note

Currently the only authorized (I-level) conversion/repair activity is the Ships Intermediate Maintenance Activity (SIMA). Requests for conversion/repair of CCFD units should be forwarded to Commanding Officer, COMNAVAIRLANT, Ships Intermediate Maintenance Activity, Code 97F, St. Juliens Creek Annex, Portsmouth, Virginia, 23702 with work request deficiency documentation and DD Form 1149 funding documentation for necessary conversion/repair parts.

2. Viewer Kit, Free-Water Detector (FWD), model (NSN 6640-00-999-2786). This instrument is used to determine the free-water content of aviation fuels. Additional materials needed to conduct tests:

   a. Detector Pad, Free-Water — NSN 6640-00-999-2785

   b. Standard, Free-Water — NSN 6640-00-999-2784.

Note

Since free-water standards deteriorate with exposure to ultraviolet light, they shall be changed and dated every 180 days.

3. The B/2 Anti-Icing Test Kit or FSII Refractometer, NSN 6630-01-165-7133. This device is used to determine the FSII content of aviation fuels.

4. API Hydrometers and a 1000-ml clear, plastic, or glass graduated cylinder NSN. These shall be

used to determine the specific API gravity of the fuel.

a. Hydrometer, Graduate 29° to 41° range, JP-5/8, NSN 6630-00-242-9258.

b. Hydrometer, Graduate 39° to 51° range, JP-5/8, NSN 6630-00-245-8376.

5. Flash Point Test Equipment. This equipment is used to determine the flash point of a fuel sample. It is absolutely essential that all activities possess one of the following instruments, since any fuel removed from an aircraft and destined for storage must have its flash point tested in order to determine its disposition.

   a. Pensky-Martens closed cup flash point tester, NSN 6630-00-530-0987. (This equipment requires use of a propane cylinder.)

   b. Electronic flash point tester (NAVIFLASH), NSN 6625-01-472-6783. (Requires N-Dodecane for calibration.)

   c. N-Dodecane Calibration Standard, NSN 6810-01-419-2677 (for use with electronic flashpoint tester).

3.4.3 Test Methods. Instructions for performing the appearance or visual test, the backbone of any fuel quality surveillance program, are contained in paragraph 3.5.2. Specific instructions are contained in the operating manuals provided with each test instrument at the time of procurement. Replacement copies of these manuals may be obtained from NAVAIR AIR-4.4.5.

3.5 INTERPRETATION OF TEST RESULTS

To be acceptable for delivery to aircraft, aviation fuel must be clear and bright and contain no visually detectable free water.

WARNING

Personnel fueling aircraft shall cease fueling operations immediately upon detecting any departure from acceptable criteria and inform the pilot, maintenance officer, or other designated person in charge as to the condition of the fuel delivered.

When off-specification fuel is identified, the source of fuel will be placed out-of-service pending investigation and any corrective action that may result. The pilot, maintenance officer, or other person in charge, when notified that doubtful or contaminated fuel has been delivered to an aircraft, will take action to determine whether the aircraft should be defueled and cleaned.

3.5.1 Test Results Action. If lab results or sampling at aircraft fueling point does not meet deterioration use limits, stop delivery of fuel to aircraft from suspected segment until the problem is corrected.

1. Resample suspected fueling nozzles and filter outlets. Deliver these samples to the quality assurance laboratory for immediate analysis. Resamples of reported contamination shall include the marking: Resample.

2. Refueling may continue while awaiting lab resample results if on board resamples meet deterioration use limits.

3. If resampling confirms the existence of unacceptable fuel, isolate contaminated section until problem is corrected.

3.5.2 Appearance (Visual Test). The test shall be conducted using a round, transparent, glass bottle, 1 quart in size. The bottle shall be clean. The sample is first visually inspected for color and presence of foreign matter. The sample shall then be swirled to form a vortex. Particles coarse enough to settle will collect as sediment on the bottom of the bottle directly beneath the vortex.

A passing sample shall be “clear and bright,” which means free of any cloud, emulsion, or readily visible particulate matter or free water. The color should be clear and colorless to straw-yellow. When any appreciable contamination is found, the test shall be repeated, paying particular attention to cleaning and rinsing the container prior to sampling. Also, if there is any question as to the quality of the fuel, both particulate and water measurements must be made using the CCFD and the FWD.

3.5.3 Particulates. Solid contaminants (rust and dirt) can be held well below a level of 1 milligram per liter (mg/L) in a properly functioning fuel distribution system. If solid contaminants in fuel at aircraft dispensing points exceed 1 mg/L, notify Aviation Fuels

Officer, investigate, and take corrective action to improve fuel quality.

WARNING

If solid contaminants exceed 2 mg/liter, delivery of fuel to aircraft shall be stopped and corrective measures completed prior to resumption of fueling operations. Loading of aircraft with fuel containing excessive contamination can result in a malfunction of the airframe or engine fuel system and subsequent loss of aircraft, pilot, and crew.

3.5.4 Free Water. A satisfactorily performing filter/separator will provide fuel containing less than 5 parts per million (ppm) of free water. Should the level of free water in fuel at an aircraft dispensing point exceed 5 ppm, a second sample will be taken immediately to ascertain if the second sample confirms that the free water exceeds 5 ppm. If so, fueling shall be stopped until changes in procedure and equipment that reduce the free water to 5 ppm or below are effected.

CAUTION

During the receipt of fuel into a storage tank, if the other tests are satisfactory but the particulate and/or free-water contamination is high (above 2 mg/liter of particulate contamination or 5 ppm of free water), extra testing and surveillance shall be conducted downstream to assure that this contamination is reduced by settling and filtration to acceptable levels before dispensing to aircraft.

3.5.5 FSII. FSII performs two important functions that help to avert significant safety-of-flight problems. First, it prevents the formation of water-ice in aircraft fuel systems, which can occur in certain susceptible aircraft. Second, FSII acts as a biostat preventing the growth of various microorganisms that can contaminate fuel systems (shipboard aviation systems as well as aircraft), block filters, and promote corrosion.

The minimum level of FSII in fuel for USN/USMC aircraft requiring FSII to prevent water-ice formation is 0.03 percent. The minimum level of FSII in aviation turbine fuel for other US services' and foreign aircraft is 0.07 percent.

CV/CVNs and air-capable ships have no means of raising the FSII level of their JP-5. FSII materials are mutagenic and considered to be dangerous in the neat state; however, they are safe once blended into the fuel. Shipboard injection of FSII is not approved. Refer to MIL-HDBK-844(AS) for guidance on raising FSII level by commingling fuel between tanks.

If the FSII level falls below the 0.03 percent limit, the appropriate Navy or Marine Corps squadron commanding officer (CO) or his/her designated representative shall be notified. Notification is required only for S-3, US-3, and SH-60 aircraft. The applicable NATOPS Aircraft Flight Manual shall be consulted by the pilots for operating instructions, which will avoid resultant safety-of-flight problems.

Transient (USAF, USA, and visiting foreign military aircraft) crew members and pilots will be notified of low FSII (levels of 0.07 percent or less) so that they may consult their appropriate technical directives for special operating instructions necessary to avoid water-ice induced problems.

WARNING

Failure to notify appropriate squadron personnel of low FSII condition can result in safety-of-flight problems.

Note

The B/2 Anti-Icing Test Kit Refractometer contains two FSII scales; one for each of the two different FSII materials currently in use. All JP-5 fuel tested shall be assumed to contain the high flash point type of FSII material, Diethylene Glycol Monomethyl Ether, or DiEGME, which is read from the scale on the B/2 refractometer marked "JP-5" or "M."

3.5.6 Other Test Results. The results of all other tests shall be evaluated by comparison with the limits described in Appendix B, which contain the Deterioration Use Limits for Aviation Fuels. The limits in these two figures refer specifically to the acceptability of

aircraft fuels for delivery to aircraft. The particular ship from which the fuel is being removed and the one into which it is being loaded must be considered when applying these use limits; a limit on free water of 5 ppm maximum or 2 mg/liter on particulates may not be applicable to a sample from a large shipment if subsequent cleanup in the fuel handling system can be anticipated.

Any activity that suspects either chemical contamination, deterioration during storage, or other unusual contamination or condition shall send fuel samples to an appropriate central fuel laboratory (see list in Appendix B of MIL-HDBK-844(AS)) for testing. Samples must be clearly labeled as discussed under identification of sample with information about the suspected problem included in the remarks section.

Inquiries pertaining to the quality or testing of aviation fuels and lubricants shall be addressed to COMNAVAIRSYSCOM (AIR-4.4.5), with a copy to NAVPETOFF.

3.5.7 Routine Correlation Samples. Compare test results obtained by the activity's in-house laboratory with those obtained by a regional fuel laboratory on the duplicate sample. (See paragraphs 3.2.3 and 3.3.4.1.) Some variation between the two test results is expected because of errors introduced by the shipment and storage of the duplicate fuel sample and differences in the test techniques. No action is necessary unless differences between the two results are greater than 0.8 mg/l. If this happens, recalibrate the CCFD following PMS, review the testing procedure, and submit and test more duplicate correlation samples. If results are still out of the acceptable range of differences, contact NAVAIR AIR-4.4.5 for further guidance.

The results of the FSII correlation sample tests should also be compared. Variation by as much as 0.03 percentage points is considered acceptable. If greater differences are noted, review the procedure, recalibrate the instrument, and take additional correlation samples and test them. If results are still out of the acceptable range, contact NAVAIR AIR-4.4.5. It may be necessary to procure a new refractometer.

3.6 GUIDELINES FOR REQUESTING REGIONAL LABORATORY SERVICES

1. Samples shall be forwarded to a Navy laboratory if practicable. See Appendix B of MIL-HDBK-844(AS) for a list of laboratories.
2. Decisions as to which laboratory to utilize shall be based upon laboratory proximity, capabilities, and workload if known.

Note

Not all laboratories are available for regular recurrent testing on a no cost basis.

3.7 REGIONAL LABORATORY TEST METHODS AND REPORTING

The following paragraphs provide instructions to regional labs that receive samples from ships.

3.7.1 Routine Samples. Laboratories receiving samples for routine fuel quality checks shall test the samples as requested on the sample label for one of the following properties using the listed American Society of Testing Materials (ASTM) method:

1. Particulate matter (sediment), ASTM D 2276
2. FSII content, ASTM D 5006
3. Flash point, ASTM D 93.

Laboratories shall also note the presence of significant amounts of free water in the bottom of the sample container. Laboratories shall not run free-water determinations on routine samples since the free-water content of the fuel is severely affected by normal shipping and handling of the sample and results are meaningless.

Note

All JP-5 fuel tested shall be assumed to contain Diethylene Glycol Monomethyl Ether.

3.7.2 Special Samples. Laboratories receiving special samples for testing shall conduct requested tests in accordance with methods authorized by the applicable fuel specification.

3.7.3 Reporting. Laboratories performing testing shall report the results to the following:

1. Original — Commanding Officer of ship submitting sample
2. One copy each — (All aviation fuel test reports)
   a. Commander
   Naval Air Systems Command (AIR-4.4.5)
   22229 Elmer Rd., Unit 4
   NAS Patuxent River
   Patuxent River, MD 20670

   b. Commander Naval Air Force
   U.S. Atlantic Fleet
   Code N433D
   Norfolk, VA 23511-5188

   or

   Commander Naval Air Force
   U.S. Pacific Fleet
   Code N4355
   Naval Air Station, North Island
   San Diego, CA 92135-5100

   c. Commanding Officer
   Navy Petroleum Office
   8725 John J. Kingman Rd.
   Suite 3719
   Fort Belvoir, VA 22060-6224

   d. Commander
   Naval Sea Systems Command
   SEA-03L
   2531 Jefferson Davis Highway
   Arlington, VA 22242-5160
   (Amphibious/air-capable ship fuel reports only)

   e. Commander, Naval Surface Force
   U.S. Atlantic Fleet
   Code N421A
   Norfolk, VA 23511-6292

   or

   Commander, Naval Surface Force
   U.S. Pacific Fleet
   Code N42
   2841 Rendova Road
   San Diego, CA 92155-5490

3.7.4 Report Forms. Regional laboratories are requested to report results on a form similar to Figure A-5 in Appendix A. It is essential that the CCFD and B/2 results reported by the sampling activity on the sample's label be included along with the results obtained by the regional laboratory.

3.7.5 Distribution Lists for Reports. It is the responsibility of the activity submitting samples to a laboratory to provide the laboratory with the desired distribution of reports in accordance with paragraph 3.7.3 above.

3.7.6 Message Reports. Message reports are mandatory for the following:

1. "Special" fuel samples
2. "Routine monthly correlation samples" that exceed the use limits for particulates or when FSII content is below 0.03 volume percent.

3.8 PROCEDURES FOR PREVENTING AND CONTROLLING CONTAMINATION

Contamination of aircraft fuel can be prevented only by the use of proper equipment and by carefully following proper operating procedures. Special "Retail," "Ready Issue," or "Service" fuel handling systems shall be used by all aircraft refueling activities to contain and process the fuel immediately prior to issue to aircraft.

Onboard ships, the fuel handling system employs special centrifugal purifiers and/or multiple filter/separator systems to clean and dry the fuel prior to its being loaded onto aircraft. It is essential that service and storage tank stripping procedures and schedules be followed to remove free water and particulates from the fuel.

The proper care, operation, and maintenance of these systems are essential in assuring that only clean, dry fuel enters aircraft. As a minimum, operators shall:

1. Observe and record the pressure drops daily across all filter/separators in order to detect failures or problems or as OSS and PMS directs.
2. Take every precaution possible to prevent the introduction of any particulate matter (dirt) into the fuel (see discussion in MIL-HDBK-844(AS)).
3. Install and maintain dust-tight caps or covers on all openings and connections, including refueling

nozzles. These caps shall be removed only when item or system is in use. Dust caps on Gammon fittings are not to be used on the flight deck.

4. Before removing cover, brush away or remove any accumulated dirt or sand around fill covers, manholes, and other covered openings.

5. Never leave any fuel tank or other vessel open to the air any longer than absolutely necessary.

6. Do not operate any fuel handling equipment unless all filters, strainers, screens, and nozzle spout caps are properly installed and in place.

7. Never remove any filter, strainer, or screen for any purpose, except for cleaning or maintenance. Always replace filter or screen immediately after cleaning in accordance with PMS.

8. Observe and report any unusual operating condition, for example, if the refueling nozzle screen requires an unusual amount of cleaning.

9. Observe water that is drained from filter/separator sumps and report any accumulation of foreign matter.

10. Flush and recirculate product in refueling system to remove condensate and particulate contaminants from lines, hoses and nozzles prior to aircraft issues. This is mandatory for any refueling equipment that has not been in use for a period of time exceeding 24 hours. Minimum circulation time must be determined locally for each piece of equipment depending on its configuration and size as well as fuel flow rate. Allow sufficient time for the fuel in the piping and hose(s) downstream of the fuel filter to be completely replaced by clean, dry fuel.

11. Ensure that regularly scheduled maintenance is properly performed.

12. Report and investigate any suspected contamination or irregularity detected.

13. Report and correct any leaking valves, lines, or connections.

14. A hose assembly that has been subjected to abuse, such as severe end pull, flattening or crushing by a vehicle, or sharp bending or kinking, shall be removed from service and inspected in accordance with PMS.

CHAPTER 4

Safety in Shipboard Fuel Handling Operations

4.1 INTRODUCTION

The focus of this chapter is safety. The fuel quality surveillance procedures of Chapter 3, the facilities and equipment requirements of Chapter 5, the operating procedures of Chapter 6, maintenance requirements of Chapter 7, and MIL-HDBK-844(AS), were all developed and established with safety as a primary goal. This chapter contains specific safety procedures and requirements that are either general in nature and therefore not covered in other chapters of this manual or are extremely important and repeated here for emphasis.

Although the procedures and requirements contained in this manual are as complete as possible, they are no substitute for a thorough knowledge of aviation fuels and their inherent characteristics and dangers. All aviation fuels personnel shall therefore be completely familiar with the information contained in MIL-HDBK-844(AS). As refueling personnel master a knowledge of aviation refueling, they will be better able to avoid and correct unsafe situations.

WARNING

Any departure from the procedures of this manual may adversely affect the overall safety of the operation being performed.

The development of safe and efficient fuel handling and aircraft refueling procedures is a continuously evolving process. Scientific investigations are coupled with actual field experience in order to establish the safest and simplest procedures possible. One of our most important sources of information in this process is the investigation of field accidents or problems. Therefore, it is extremely important that knowledgeable personnel be involved in accident investigations, especially whenever explosions or fires have occurred. Activities shall therefore request the assistance and participation of experts whenever major fuel accidents are being investigated to ensure that correct conclusions are drawn. NAVSEA, NAVAIR, and TYCOM will assist in the identification of appropriate experts for specific investigations.

WARNING

Always assume that fuel vapors (in a tank, above a pool of fuel, etc.) are in the flammable range; i.e., proper fuel-air mixture to ignite.

4.2 SPECIAL SHIPBOARD SAFETY PRECAUTIONS

In addition to the general safety precautions contained in this chapter, the unique nature of the shipboard environment warrants a few specialized safeguards.

1. All fuel movement shall be secured during emergencies such as fire or flooding.
2. Lighted cigarettes or exposed flames of any kind shall not be permitted in the vicinity of open tanks, pipes, or containers carrying aviation fuel.
3. The smoking lamp shall be out in the vicinity of the aircraft during fueling or defueling operations.
4. Every effort should be made to minimize the number of personnel in the vicinity of aircraft during fuel operation.
5. During all fueling operations the use of fueling signals/signal wands is mandatory by fuel crew personnel.
6. Fueling or defueling of an aircraft supported by jacks is strictly prohibited.

7. Loading of forward firing ordnance requiring simultaneous and/or prior electrical connections for loading is not authorized while fueling of that aircraft is in progress. No other electrical connections for loading or removal/installation of impulse cartridge shall be accomplished while fueling. Fuel hoses shall not be positioned under weapons being loaded/downloaded.

8. When fueling or defueling aircraft, a PQS qualified member of the Aviation Fuels Division shall be present to ensure all operations are conducted per applicable instructions.

9. When the JP-5 system is to be operated, the Aviation Fuels Officer or the Aviation Fuels CPO shall be present and in direct charge. He is responsible to see that all personnel comply with all existing instructions and directives and that all necessary safety precautions are strictly adhered to and that all communications are established and operable prior to operation of the system.

10. Fire fighting equipment shall be operational prior to refueling/defueling in the hangar deck.

11. Approved Emergency Air Devices shall be provided for each manned space (number required is subject to maximum manning level per space, i.e., one per person).

12. Grounding wires for personnel shall be serialized and inventoried daily at sea to minimize the possibility of foreign object damage (FOD).

4.3 ELIMINATING SOURCES OF IGNITION

4.3.1 Reducing Electrostatic Charges. One of the primary sources of ignition is static electricity. To ensure the safe relaxation of static charges relevant to fuel operations, all units shall:

1. Refill filter/separator vessels slowly, whenever they have been drained.

2. Always electrically ground from the deck to the aircraft in accordance with MIL-HDBK-274(AS).

3. Bond over-the-wing (gravity) refueling nozzles to the aircraft using a separate bonding pig-tail before tank's caps are removed.

4. Attach bonding cables to aircraft using plug and jack method whenever available.

5. Inspect bonding and grounding cables, clamps, and plugs on a daily basis or in accordance with PMS.

6. Secure all external fueling evolutions when electrical storms are within a vicinity of five miles.

7. Not conduct fuel operations in the immediate vicinity of an electrical storm.

4.3.2 Eliminating Other Sources of Ignition. To prevent or eliminate sources of ignition, activities shall observe the following:

1. Do not allow fuel personnel to wear shoes with nails or other metal devices on the soles that might cause sparking.

2. Require fuel personnel to wear non-static producing clothing such as cotton.

3. Check the exhaust piping daily on all support equipment to ensure that holes, cracks, or breaks do not exist.

4. Before attempting to fuel aircraft, attach grounding wire connection to discharge static electricity. Attach the ground wire to the deck before attaching to the aircraft.

5. Do not introduce portable lights except safety lights into any compartment or space where fuel or flammable vapors may be present. (API has determined that ordinary commercial two- and three-cell flashlights, using carbon zinc dry cell batteries, may be safely used around flammable fuel/air mixtures. Tests have proven them incapable of igniting vapors, even if accidentally dropped or when the light bulb is crushed.)

6. Do not allow fuel personnel to carry "strike anywhere" matches or cigarette lighters in pockets.

7. Be certain oxygen servicing other than converter replacement at the aircraft and fueling are conducted as separate evolutions.

8. Be certain that aircraft radar and all unnecessary radio equipment are switched off before refueling

or defueling begins. If it is necessary that equipment be on for warm-up prior to an immediate launch, be sure that it is not transmitting. The only exception to this rule occurs during hot refueling. During such refueling operations the pilot must maintain radio contact with the tower at all times.

9. Equip all internal combustion engines being operated onboard ship with spark-arresting type mufflers.

10. Conduct gravity (over-the-wing) refueling only if the aircraft is solely configured for gravity fill operations.

11. Hold hot refueling operations to the absolute minimum possible and then only in accordance with specific aircraft NATOPS guidance.

4.4 REDUCING OR CONTROLLING VAPOR GENERATION

In order to help prevent fires by reducing or controlling vapor generation, units shall:

1. Handle fuel in approved containers only.

2. Keep all fuel containers, such as aircraft fuel tanks or vessels, closed except when necessary to open for actual operation.

3. Avoid spilling fuel during fuel handling operations.

4. Take immediate action to clean up any spill that occurs. Wipe or absorb small spills with rags or adsorbents. Follow local emergency procedures for large spills.

5. Dispose of oily waste or rags immediately after using by placing in self-closing metal containers.

6. Report all leaks in any portion of the fuel handling system.

7. Treat empty or apparently empty cans or containers that formerly held aircraft fuels as though they still contain fuel. These containers still contain vapors and are dangerous for many days after they have been emptied.

8. Be aware that fuel vapors are heavier than air and will collect in low places.

9. Never dispose of waste fuel in deck drains, laboratory deep sinks, or sanitary sewage systems/ contaminated holding tanks (CHTs).

4.5 MISCELLANEOUS SAFETY PROCEDURES

All units shall:

1. Use all fire extinguishers only for their intended purpose, that is, to extinguish fires. They shall never be used to inert a fuel tank.

2. Keep all equipment and work areas neat, clean, orderly, and in good mechanical condition.

3. Ensure that firefighting equipment and extinguishers are in good condition and readily available.

4. Never use gasoline as a cleaning agent.

5. Do not refuel aircraft with demonstrated unreliable fuel vent or dump systems over hot catapults.

4.6 EXTINGUISHING FIRES

Although the ship's crash crew has prime responsibility for firefighting, all fuel handling personnel should be aware of the basic principles involved in extinguishing fires as well as the equipment used. They should also make certain that appropriate firefighting equipment is readily available whenever and wherever fuel handling operations are being conducted. For maximum effectiveness and safety, fire extinguishers must be operated in accordance with the specific procedures developed for each individual type. MIL-HDBK-844(AS) contains a special section on fire extinguishment, which has been extracted from NAVAIR 00-80R-14, U.S. Navy Firefighting and Rescue NATOPS Manual. All refueling personnel shall be thoroughly familiar with this basic information.

4.7 MINIMIZING HEALTH HAZARDS

Aviation fuels must be handled with caution because of the obvious dangers associated with possible fires and/or explosions, and because these materials themselves present a danger to the health of fuel handling

personnel. These dangers are equally important as those of fires and explosions even though they are not so well known. MIL-HDBK-844(AS) contains a detailed discussion of the health hazards of aviation fuels.

In order to minimize the health dangers, fuel handling personnel shall:

1. Never enter tanks and voids where fuel vapors are present, without permission of the commanding officer.

2. Keep to an absolute minimum the amount of time spent breathing fuel vapors. Good ventilation of work spaces is mandatory.

3. Stay on the windward, or upwind, side of the spill when it is necessary to remain in an area where a large spill has occurred.

4. Stop the fuel handling operation and move to a fresh air location immediately if dizziness or nausea occurs.

5. Avoid skin contact with liquid fuels and tank water bottom that can contain a high concentration of FSII. If fuel or water bottoms does contact the skin, wash with soap and water immediately.

6. Never wash hands with gasoline or jet engine fuels.

7. Remove fuel-soaked clothing or shoes at once.

8. Wear cranial, goggles, gloves, and clothing that leaves the minimum amount of skin exposed during refueling/defueling operations. This practice will minimize burns in a fire.

9. Use only footwear that completely covers the feet in order to provide protection against fuel spills and fires. Shoes made of fabric or other absorbent materials are not acceptable.

4.8 CONFINED SPACES

Personnel entering or working in or around confined spaces exposed to fuels and fuel vapors may encounter potential hazards. For definitive information regarding the hazards of confined spaces, hazardous environments, and gas-free engineering consult NAVSEA S6470-AA-SAF-010, U.S. Navy Gas-Free Engineering Program Technical Manual. All personnel shall comply with the Navy policies and procedures specified in this gas-free engineering manual.

CHAPTER 5

Shipboard Aircraft Refueling System and Equipment

5.1 GENERAL REQUIREMENTS

This chapter describes the basic requirements for aviation fuel handling equipment for ships that fuel aircraft. Shipboard systems are designed and constructed in accordance with the applicable NAVSEA ship design specification.

WARNING

Any departure from the minimum equipment/facilities requirements established in this manual may adversely affect aircraft safety-of-flight as well as the safety of fuel handling operations.

5.1.1 Filtration Requirements. All ships or activities that refuel aircraft shall process the fuel issued to aircraft through an absolute minimum of two fuel cleaning or filtration devices before loading the aircraft.

5.1.2 Maximum Refueling Pressure. All aircraft pressure refueling systems must be designed to limit the maximum pressure at the aircrafts adapter (the downstream side of the nozzle) to 55 psi (static or dynamic). During the last few seconds of a refueling operation the aircraft's internal tank shut-off valves close, creating an instantaneous pressure surge within the aircraft's fuel system. The pressure control device on every refueling system must react quickly enough to limit this surge pressure to below 120 psi. All Navy and Marine Corps aircraft are designed, built, and tested for refueling within these pressure limitations.

5.1.3 Pressure Refueling Nozzles. Only those Single Point Refueling (SPR) nozzles (also referred to as underwing, type D-1 or type D-2) qualified to the requirements of SAE AS5877 are approved for use. Nozzles shall be equipped with 60-mesh or finer strainers. A quick disconnect sampling connection shall be provided on the nozzle for taking fuel samples and for pressure checks. Sample connections shall be flush type, dry break quick disconnects (for example, Gammon fittings) with dust plugs. Gammon fitting dust plugs shall not be used on flight decks since they present a foreign object damage (FOD) hazard to the aircraft.

5.1.4 Closed Circuit Refueling (CCR) Nozzle. This pressure fueling nozzle is used for helicopter in-flight refueling operations. These nozzles can fit onto Army helicopters adapters, but they regulate pressure to 45 psig in contrast to the standard 15 psig Army requirement. This is because Naval aircraft can be refueled up to 55 psig while Army aircraft allow either 15 psig or 55 psig, depending on model. The UH-60 (Blackhawk) and AH-64 (Apache) can be refueled with the 45 psig CCR HIFR nozzle while the UH-1 (Iroquois), AH-1 (Cobra), OH-6 (Cayuse), and OH-58 (Kiowa) cannot.

5.1.5 Overwing Refueling Nozzle. An overwing nozzle is also referred to as "gravity" and "open port." Nozzles shall meet the requirements of MIL-N-87963. Overwing nozzles shall have a strainer of 60 mesh or finer and a tube spout suitable to the type of fuel and aircraft being serviced. Each over-the-wing nozzle shall have permanently attached a flexible bonding wire of suitable length terminating with a plug type connector. (A clamp type connector may be used if it conforms to MIL-C-83413.)

5.1.6 Nozzle Flushing Connection. The SPR flushing connection shall conform to MIL-A-25896 with dust cover.

5.1.7 Hose End Pressure Regulator (HEPR). The HEPR or Hose End Control Valve (HECV) is qualified with the nozzle assembly to MIL-N-5877. The use of the HEPR allows system pressures to be optimized to improve flow rates, while regulating the

pressure at the skin of the aircraft to a nominal pressure of 55 psi.

5.2 SHIPBOARD AIRCRAFT REFUELING SYSTEMS

5.2.1 On-Deck Refueling Systems. Two types of aircraft fuel systems are in use aboard ship. Aviation ships (CVN, CV, LHA, LHD, LPD) have aviation fuel systems incorporating a pressure and flow control valve (e.g., CLA-VAL) that controls service system delivery pressure. Air-capable ships have aviation fuel systems incorporating an unloader valve that controls service system delivery pressure. Aviation ships shall use D-1 refueling nozzles. Air-capable ships shall use D-1R nozzles (D-1 with a hose end pressure regulator). Figures 5-1 and 5-2 illustrate the major features of these two systems. Refer to NSTM 542 for a detailed discussion of these systems.

5.2.2 Helicopter In-Flight Refueling Equipment. All HIFR-capable ships are equipped with one of two different rigs for HIFR as discussed below.

5.2.2.1 NATO High Capacity (NHC) HIFR. (See Figure 5-3.) This rig features a 100-foot, 2-inch lightweight hose, unisex couplings, and automatic emergency breakaway and facilitates the use of either a CCR nozzle or a D-1 nozzle (SPR) for HIFR operations. The NHC has two major assemblies:

1. Deck assembly kit — 100 feet of deck hose configured with unisex couplings and an overwing nozzle with unisex coupling. The standard D-1 nozzle will be reconfigured to end in a unisex coupling.

2. HIFR kit — 100 feet of lightweight hose with the deck tie-down, 10-foot section with the automatic breakaway and the CCR nozzle and a recirculation adapter to flush the CCR nozzle. The CCR nozzle has a built-in 45 psi pressure regulator and an on/off flow control handle that allows the crewman to control fuel flow on and off. Emergency breakaway is initiated when 450 ±50 pounds of straight tensile pull is exerted on the automatic breakaway coupling. The mount for the hoist cable has been designed for self-alignment between the winch and deck tie-down to assure straight pull.

Note

- Emergency breakaway occurs automatically as the helicopter moves away from the ship. No action by aircrew is necessary.

- Nearly all U.S. Navy and Marine Corps HIFR capable helicopters are outfitted with a CCR connection for HIFR while the helicopters of other NATO countries use an SPR connection.

- A special recirculation adapter (nozzle) is provided with the NHC rig. It allows the CCR nozzle to be attached to the ships flushing connection (SPR adapter). This "recirculation nozzle" is outfitted with a fuel sampling port since the CCR nozzle cannot be configured with one.

5.2.2.2 North Island (NI)/Wiggins HIFR Rig. (See Figure 5-4.) This rig has a ship's hose (100 feet in length) and an HIFR assembly, which is a 10-foot section of 15/16-inch hose outfitted with a saddle for hoisting the HIFR assembly and hose to the aircraft. Both ends of the HIFR assembly are equipped with female POL/closed circuit refueling CCR fittings (also referred to as Wiggins fittings). A MANUAL emergency disconnect lanyard (emergency release "T" handle) is located near the POL/Wiggins fitting on the HIFR assembly, which connects to the male POL/Wiggins fitting in the helicopter. The second POL fitting connects the HIFR assembly to the ship's hose. This rig incorporates a manual breakaway that requires a helicopter crewmember to pull a lanyard to effect breakaway. This older HIFR rig is being phased out of service.

5.2.3 Fuel Testing Laboratory. All ships that refuel aircraft are required to have a fuels laboratory where the fuel quality surveillance tests can be performed safely (see paragraph 3.4.1). Ships that refuel multiple aircraft shall have a laboratory that meets the following minimum requirements:

1. Lighting and fixtures in accordance with applicable ships' specifications

2. Climate control, for example, air-conditioning/heating

3. Sink with running hot and cold water

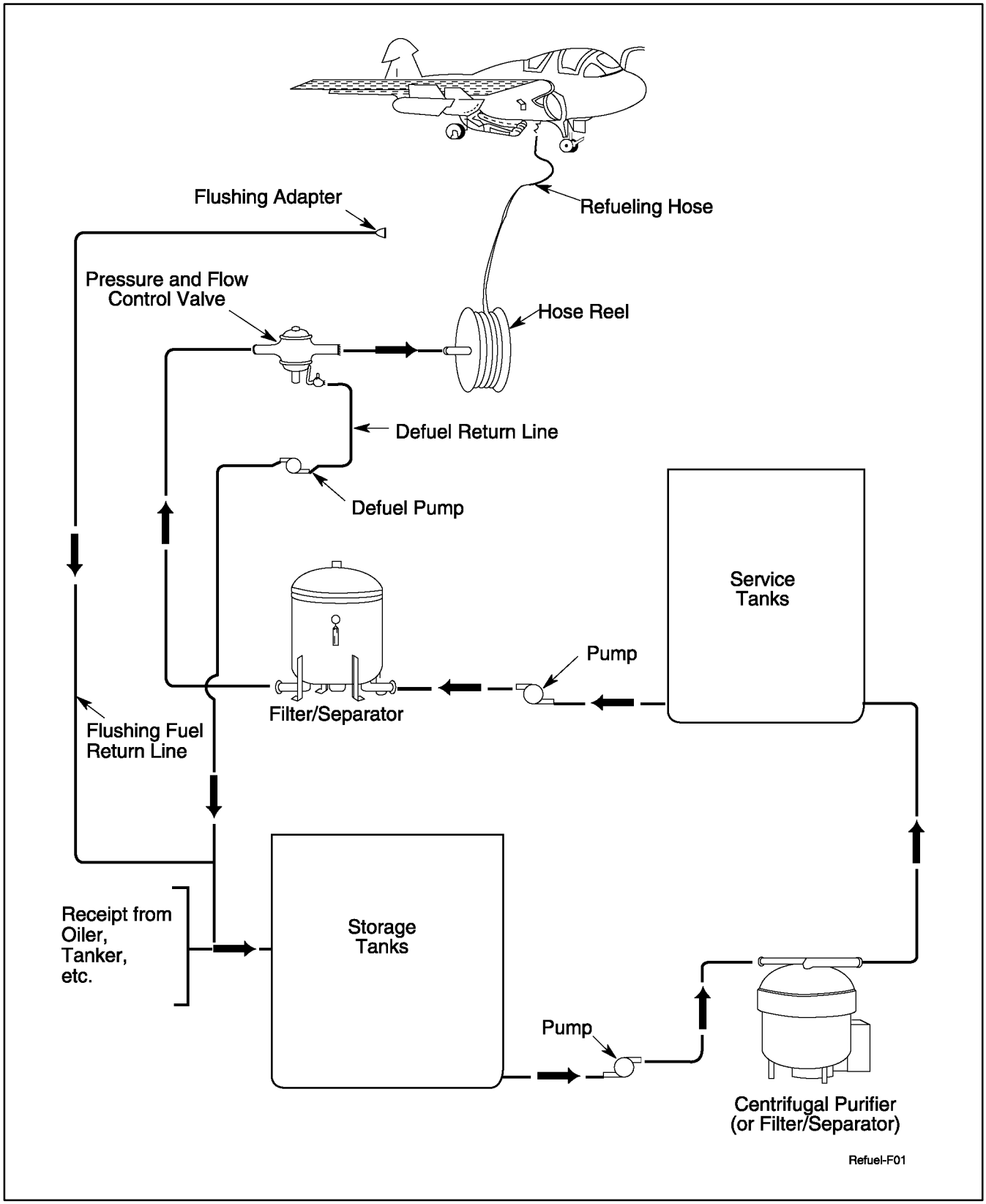


Figure 5-1. Shipboard Aircraft Fueling System Flow Diagram — Aviation and Amphibious Assault Ships

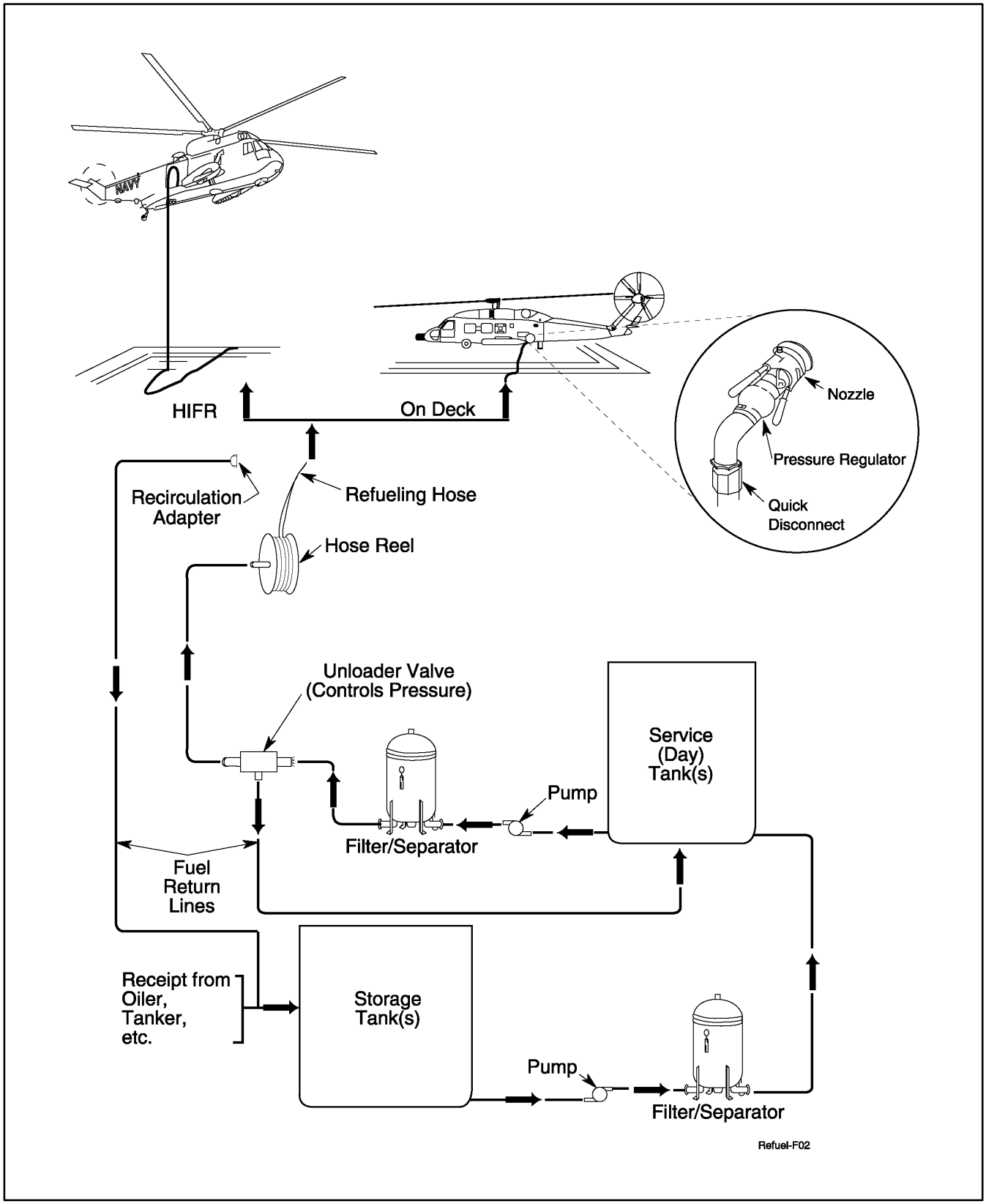


Figure 5-2. Shipboard Aircraft Refueling System Flow Diagram — Air-Capable Ships

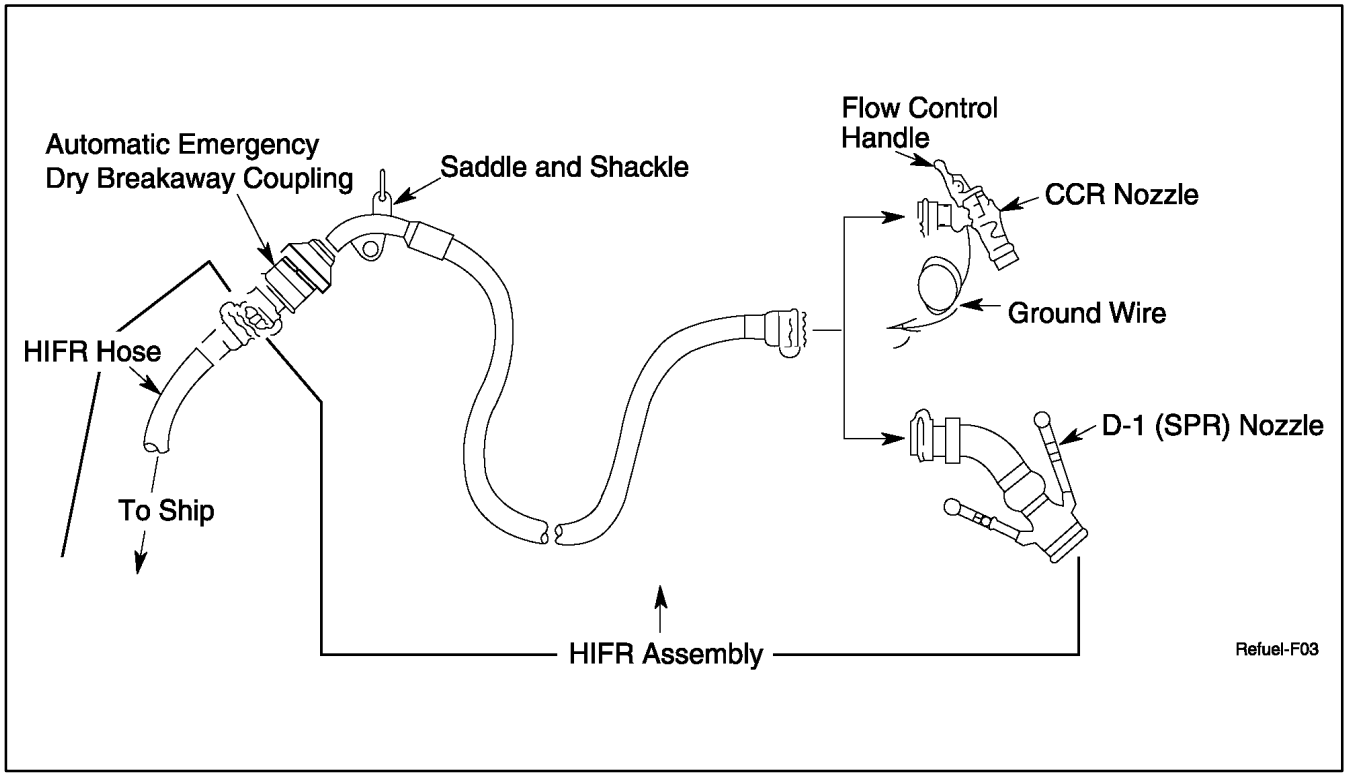


Figure 5-3. NATO High-Capacity (NHC) HIFR Assembly

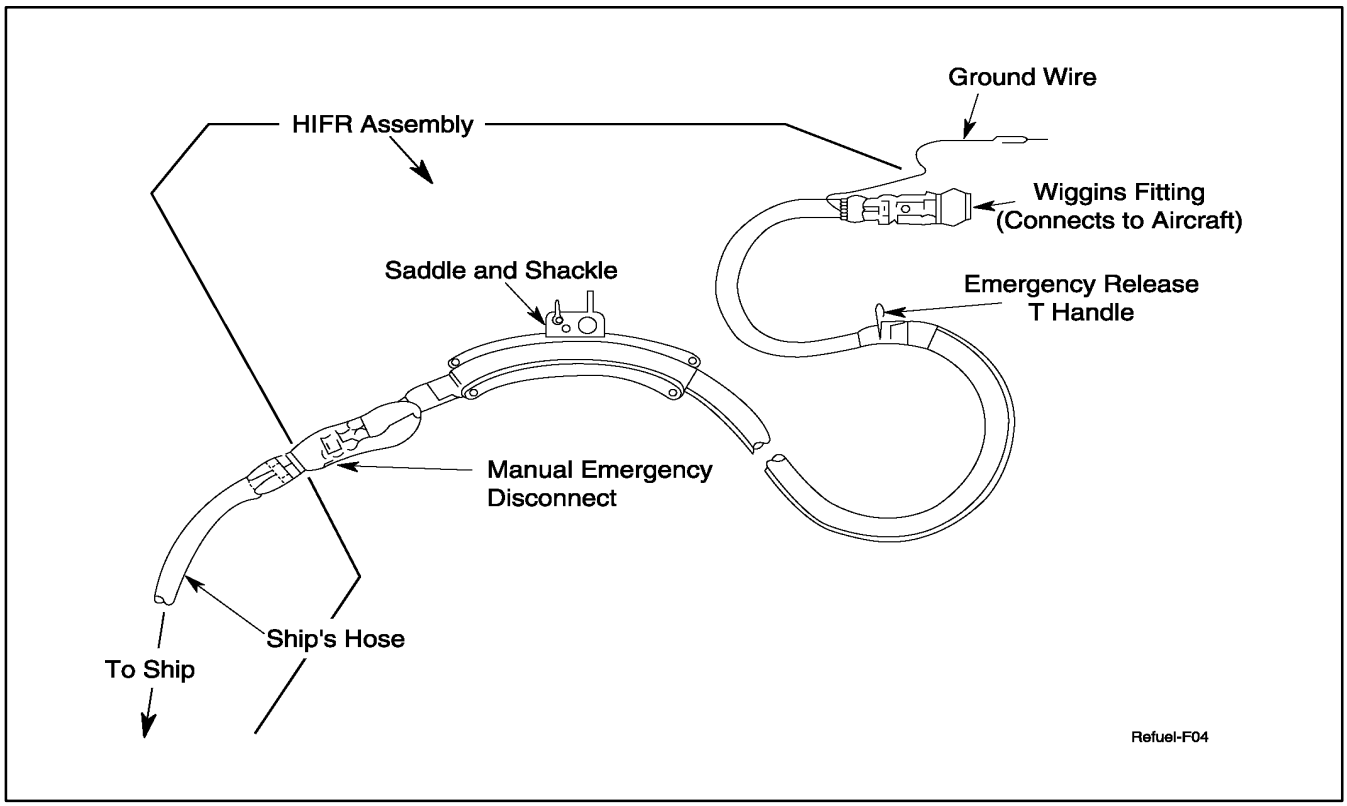


Figure 5-4. Wiggins/North Island (NI) HIFR Rig

4. Work bench(s) or counter(s) of sufficient size to accommodate all required test equipment such that each device is maintained in a ready-to-use position. This is essential in order to minimize recalibration efforts that are required anytime the equipment is moved.

5. Storage cabinets for test equipment support items, for example, bottles, drying rack, spare millipore pads

6. Hydrometers

7. CFD or the CCFD

8. FWD or CCFD

9. B/2 Anti-Icing Test Kit

10. Pensky-Martin or Naviflash flash point tester

11. Thermometers

12. Fume hood.

Note

It is recommended that each activity possess at least two CCFDs and two FWDs in operating condition. The second unit is a back-up in case the primary unit fails. Aircraft refueling operations shall not be performed if fuel contamination levels cannot be routinely tested as required by Chapter 3 of this manual.

Ships that do not have a laboratory and/or fume hood shall designate a specific area in the ship with good ventilation where the testing equipment listed in paragraph 3.4.2 can be stored and conveniently set up and operated on a moment's notice.

CHAPTER 6

Shipboard Operating Procedures

6.1 INTRODUCTION

This chapter establishes minimum operating procedures to assure safe handling of aviation fuel. The operating procedures presented and discussed in this chapter are for general types of fuel facilities and equipment common to all ships engaged in the fueling of aircraft. They include the basic steps that, for safety reasons, must be performed with each fuel handling operation with particular emphasis on the fueling of aircraft. Any departure from the procedures of this chapter may adversely affect the overall safety of the operation being performed.

Fuel operators shall discontinue any fuel operation that does not appear to be progressing in a normal fashion (that is, appears to be taking much longer than would normally be expected, or pressures are too high, too low, etc.) or when a safety violation is in evidence, and immediately notify the Fuels Officer or FMO.

WARNING

Failure to terminate an operation that is progressing abnormally can lead to a catastrophic accident.

6.2 SHIPBOARD AIRCRAFT REFUELING PROCEDURES

The following shipboard operating procedures cover only those activities directly involved with the refueling of aircraft. They do not cover the below-deck operations that must be performed in conjunction with the aircraft refueling operation. The procedures presented here have been developed to assure compatibility between shipboard procedures and those published in the individual NATOPS Manual for each aircraft.

General shipboard operating procedures, including below-deck activities as well as aircraft refueling, are contained in the Naval Ships' Technical Manual, Chapter 542, NAVSEA S9086-SP-STM-000/CH-542 and in the Description and Operations of Aviation Fuel System, S9542-AA-MM0-010. Ships that have been outfitted with an Operational Sequencing System (OSS) have OSS Manuals that contain very detailed operating instructions for their shipboard systems.

6.2.1 Operation of the JP-5 System. All operations involving the JP-5 system shall be conducted by qualified operators per the AVFUELS (Afloat) PQS. Trainees may operate the system, but only under the direct supervision of a qualified operator. All operations of the Aviation Fuel (AVFUEL) system shall be done in strict accordance with Operational Sequencing System (OSS) or local procedures.

Note

A fueling crew consists of a qualified crew leader with established communications, a minimum of one qualified crewman per hose in use, and a plane captain. A PQS qualified fuels flight deck supervisor shall be available "on deck" to coordinate fueling operations and to act as Safety Petty Officer.

6.2.2 Log Books. JP-5 quality assurance fuel sample log, filter sample/pressure drop log, and equipment running logs shall be maintained in the formats found in Figures A-6 through A-8. Each log shall be reviewed by the supervisor, CPO and Maintenance Officer daily and kept in division files for 6 months.

6.2.3 Aircraft Pressure Refueling with Engines Off (Cold Refueling). A minimum of three people are needed for refueling an aircraft: refueling crewman, refueling station operator, and a plane captain. A crewleader (safety person) is also recommended but it is possible for the safety person to supervise more than one fueling operation simultaneously.

Aircraft refueling tasks are to be performed in the following sequence:

1. Secure all electronic and electrical switches on the aircraft not required for fueling.

2. Verify that manned firefighting equipment is in the area.

3. Take sample, if needed, for quality surveillance checks. Fuel sample shall be taken under flow conditions. Fuel shall be flushed through refueling hose and nozzle and tested for contamination prior to refueling the first aircraft each day not to exceed 24 hours. Fueling shall not begin until acceptable results have been obtained, i.e., less than 2 mg/l and 5 ppm free water. (See Chapter 3.)

WARNING

Failure to provide clean, clear, and bright fuel to aircraft can adversely affect safety-of-flight.

4. Check for "hot brake" condition (plane captain).

5. Attach grounding cable from the deck to the aircraft.

WARNING

- Aircraft tie-downs shall not be removed or altered during aircraft refueling evolution.

- Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until evolution is completed. This means:

  a. NO aircraft engines or auxiliary power units shall be started.

  b. External power shall NOT be connected, disconnected, or switched on or off.

  c. Changing the aircraft's electrical power status can create significant ignition sources.

Note

- Aircraft must have initial tie-downs prior to attachment of the grounding cable. Refer to individual aircraft NATOPS.

- Grounding (bonding) connections shall be made to bare metal.

- Refueling shall not be performed unless a qualified plane captain/aircrew is present.

6. Position the fuel hose.

7. Remove refueling adapter cap from the aircraft and the dust cover from the SPR nozzle. Inspect the face of the nozzle and make sure it is clean. Inspect index pin area for excessive wear. Verify that the flow control handle is in the fully closed and locked position.

8. Visually inspect the aircraft's adapter (receptacle) for any damage or significant wear. If there is any doubt about the integrity of the adapter, notify the squadron representative who shall utilize the adapter go/no-go gauge (NSN 1RW-5220-01-301-9247) or alternate go/no-go gauge (NSN 5220-01-343-1688) to determine acceptability.

WARNING

A worn or broken adapter can defeat the safety interlocks of the refueling nozzle permitting the poppet valve to open and fuel to spray or spill.

9. Confirm that the switch on the nozzle quick disconnect coupling (QDC) is in the OFF position.

Note

This step is not applicable to air-capable ships since they do not have a QDC with the switch.

10. Lift nozzle by lifting handles, align the lugs on the nozzle with the slots on the aircraft adapter, and hook up the nozzle to the aircraft by pressing it firmly onto the adapter and rotating it clockwise to a positive stop.

WARNING

Nozzle must seat firmly on the adapter and not be cocked. Cocking can indicate a malfunction of the nozzle's safety interlock system that can lead to a fuel spray or spill.

Note

The recessed fuel panel of the Army AH-64A/D helicopter may cause interference with the original version of the Carter #64349 SPR nozzle. This nozzle must be mounted with the flow control handle oriented at the 8 o'clock position, to allow full travel of the handle.

11. Upon receiving signals from the nozzle operator that hook-up is complete and from the plane captain that he/she is ready to begin fueling operation, the station operator opens the appropriate valve (for air-capable ship only). The station operator must remain in position at controls throughout the entire fueling operation.

12. Place QDC switch in the ON (fuel) position (does not apply to air-capable ships).

13. When hose is fully charged, rotate the nozzle flowcontrol handle to the FULL OPEN position. The handle shall rotate 180 degrees to ensure that the poppet valve is fully open and locked.

WARNING

The flow control handle of the SPR nozzle shall be placed in either of two locked positions — fully open or fully closed. The handle is NOT to be used as a flag to indicate fuel flow. Excessive wear on the aircraft adapter and the fuel nozzle poppet will result if the handle is allowed to "float" in the unlocked position.

14. Once fuel flow has been established, squadron personnel shall exercise the aircraft's precheck system.

Note

- The precheck system simulates the completion of refueling by closing all of the tank shut-off valves within the aircraft. All fuel flow into the aircraft should stop within a few seconds to 1 minute of actuating the precheck system. On ship the primary means of detecting successful precheck is by observing the flow indicator on the aircraft. If the aircraft is not configured with indicator, an alternate method is to observe the jerk and stiffening of the refueling hose and/or the pressure spike that occurs at the refueling station.

- If an aircraft fails precheck it can be cold refueled only if procedures are called out in the specific aircraft NATOPS.

- Refueling crewmembers will not perform prechecks on aircraft. Qualified personnel will perform the prechecks in accordance with specific aircraft NATOPS.

15. Fuel aircraft as directed by flight plan. The plane captain shall monitor aircraft vents, tank pressure gauge(s) and/or warning lights as necessary.

16. When directed by the plane captain, place the quick disconnect switch in the off position. Rotate the nozzle flow control handle into the OFF and fully locked position.

17. When hose is evacuated, disconnect nozzle from the aircraft adapter, replace adapter cap, and remove ground wire from aircraft, then deck.

18. If applicable, shut down refueling station.

19. Restow hose.

6.2.4 Overwing Refueling. Overwing (gravity) refueling can be performed only with the engines off. The following tasks shall be performed in the following sequence:

WARNING

Overwing refueling with the aircraft's engines operating is NOT authorized.

1. Secure all electronic and electrical switches on the aircraft not required for fueling (plane captain).

2. Verify that manned firefighting equipment is in the area.

3. Take sample if needed for quality surveillance checks. Fuel sample shall be taken under flow conditions. Fuel shall be flushed through refueling hose and nozzle and tested for contamination prior to refueling the first aircraft each day.

Fueling shall not begin until acceptable results have been obtained, that is, less than 2 mg/l and 5 ppm free water. (See Chapter 3.)

WARNING

Failure to provide clean, clear, and bright fuel to aircraft can adversely affect safety-of-flight.

Note

Recirculate the refueling station and take samples with the SPR nozzle in place, then replace the SPR with overwing nozzle immediately before commencing refueling operations.

4. Attach grounding cable from the deck to the aircraft.

WARNING

Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until evolution is completed. This means:

a. NO aircraft engines or auxiliary power units shall be started or stopped.

b. External power shall NOT be connected, disconnected, switched on or off.

c. Changing the aircraft's electrical power status can create significant ignition sources.

Note

- Aircraft must have initial tie-downs prior to attachment of the grounding cable. Refer to individual aircraft NATOPS.
- Grounding (bonding) connections shall be made to bare metal.

5. Reel out and position the fuel hose.

6. Confirm that the switch on the nozzle QDC is in the OFF position.

Note

This step is not applicable to air-capable ships since they do not have a QDC with switch.

7. Bond the overwing nozzle to the aircraft as shown in Figure 6-1 and then remove the filler cap from the aircraft.

WARNING

Always bond the nozzle to the aircraft before the filler cap is removed. This connection shall remain in place until the entire fueling operation is complete. Failure to bond can result in a dangerous static spark inside the fuel tank.

8. Insert overwing nozzle into aircraft's refueling port and maintain metal to metal contact between the overwing nozzle and the aircraft's refueling port throughout the entire fueling operation.

9. Upon receiving signals from the nozzle operator that the plane captain is ready to begin fueling operation, the station operator opens the appropriate valve (for air-capable ship only). The station operator must remain in position at controls throughout the entire fueling operation.

10. Place QDC switch in the ON (fuel) position (does not apply to air-capable ships).

11. Fuel aircraft as directed by flight plan. The plane captain shall monitor aircraft vents, tank pressure gauge(s), and/or warning lights as necessary.

12. The plane captain will stop fuel flow.

13. Place the QDC switch in the OFF position.

14. Remove nozzle and replace filler cap. Disconnect nozzle bonding cable after cap has been replaced.

15. Remove ground wire from aircraft, then deck.

16. If applicable, shut down refueling station.

17. Restow hose.

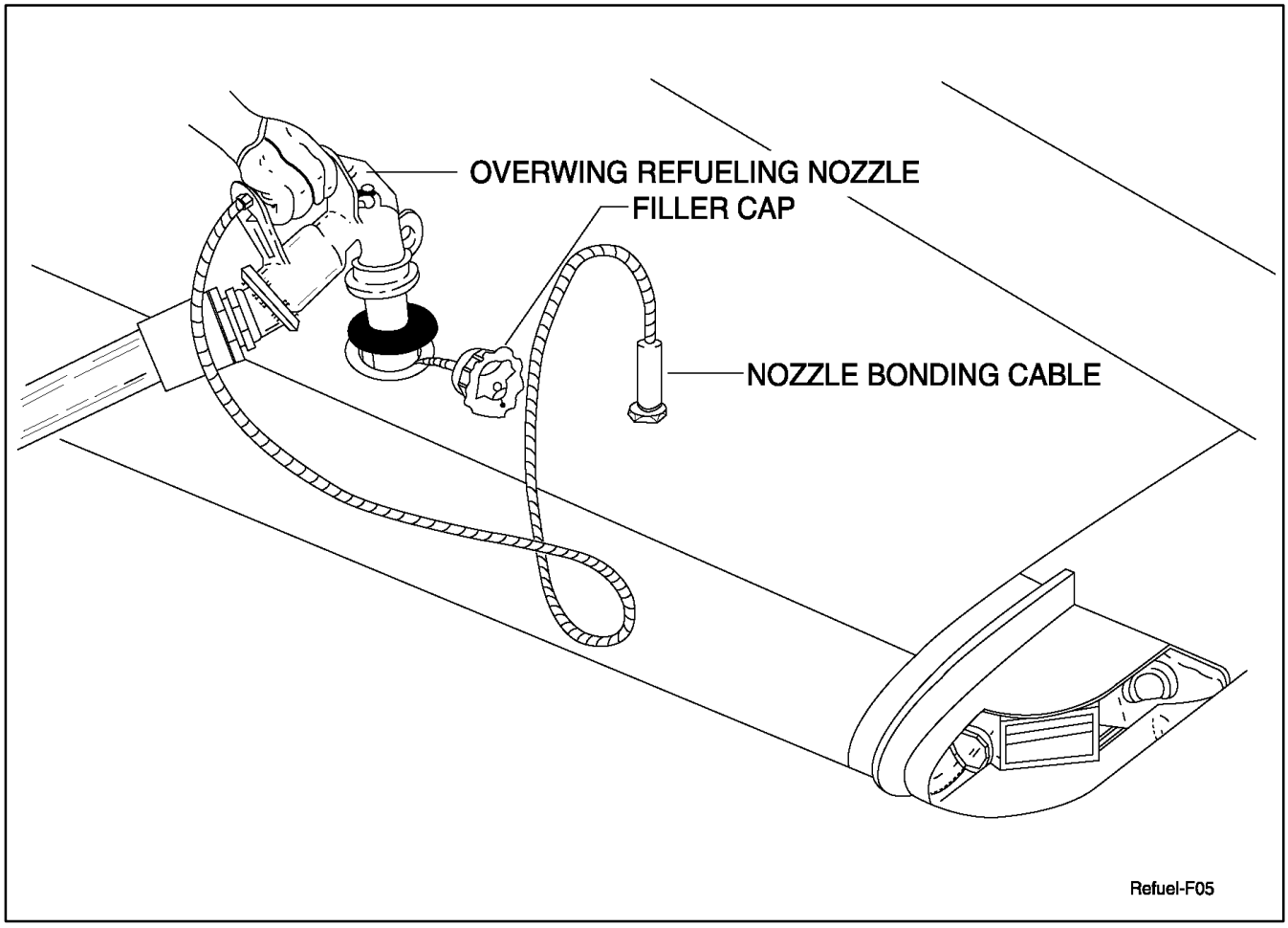


Figure 6-1. Electrical Bonding of Overwing Refueling Nozzle to Aircraft

6.2.5 Aircraft Pressure Refueling with Engines Operating (Hot Refueling). Hot refueling procedures are the same as the cold refueling procedures listed in paragraph 6.2.3 with the following additions:

The following steps must be accomplished prior to the initiation of the refueling operation:

1. Aircraft pilot shall select fuel loading, ensure that the cockpit switches are in the proper positions, and maintain UHF radio contact with the Primary Flight Control (PriFly).

2. Pilot shall secure all unnecessary electronic and electrical equipment not required for refueling.

3. Pilot shall place all armament switches in the SAFE position.

WARNING

- Servicing the AV-8B's water injection system/tank is NOT authorized during hot refueling.

- Aircraft shall not be hot refueled if it fails precheck. Failure of the precheck indicates a malfunction in the aircraft's fuel system, which can result in a fuel spill and fire.

- Aircraft canopy and helicopter side doors (if installed) shall remain closed during the entire refueling evolution. Aircraft refueling operations shall be secured if canopy is opened.

WARNING

- Crew changes and hot seating shall not be conducted during hot refueling.

  Exceptions:

  — Rear cargo doors and/or doors on opposite side of aircraft from the refueling adapter may be open, provided the refueling hose is positioned so that it is unlikely fuel sprays from nozzle/adapter malfunction or hose rupture will enter aircraft passenger/cargo/cockpit compartment(s).

  — The AV-8B aircraft may be hot refueled with the canopy open at the pilot's discretion when high temperatures and humidity dictate, since the aircraft's environmental control system does not operate with weight on wheels.

- The engine with the propeller or intake nearest the aircraft fueling receptacle shall be secured. Deviations are permitted only when specific aircraft NATOPS states to leave both engines running.

4. Obtain samples from each aircraft fueling nozzle after flushing and prior to commencing aircraft operation in accordance with PMS/OSS directives. During flight operations, obtain samples periodically from random nozzle in use.

Note

Samples drawn during static (no flow) conditions are not representative of the full fuel flow and may give false high contaminant results.

Hot refueling shall be performed using only the SPR or CCR nozzle and aircraft receptacle.

WARNING

Aircraft shall not be gravity refueled with the engines operating because of the increased probability of a fuel spill and fire.

6.2.6 Helicopter In-Flight Refueling (HIFR) Procedures. HIFR is performed to extend a helicopter's on-station time. Hot refueling (refueling on deck while rotors are turning) is preferable to night HIFR. A minimum of four ships' crewmen in addition to the LSE are needed on-deck to conduct an HIFR operation, i.e., one to attend the refueling station, two to attend the HIFR hose, and one hook-up man. The following procedures focus on the on-deck duties of the ship's refueling crew. Additional information on HIFR operations is contained in the Shipboard Helicopter Operating Procedures Manual, NWP 42, and the Naval Ships' Technical Manual Chapter 542.

1. All components of the HIFR rig shall be checked for electrical continuity in accordance with PMS.

2. The HIFR rig shall be connected to the ship's aviation refueling system and pressurized to check for leaks during flushing operations.

WARNING

The NI HIFR rig can be attached backwards. The emergency release "T" handle must be on the side of the saddle with the Wiggins "POL" fitting that will be connected to the aircraft's receptacle (see Figure 5-4) in order for the aircrew to effect emergency release.

Note

The configuration of the SH-3H helicopter requires a greater length of hose between the HIFR saddle and the aircraft fuel connection than is normally required for other modifications of the SH-3 helicopter. It may be necessary to adjust the NI HIFR rig by repositioning the saddle to the farthest inboard position to ensure adequate distance between the saddle and the nozzle.

3. The HIFR nozzle shall be attached to the recirculation adapter and flushed with fuel.

4. During recirculation, a fuel sample shall be taken from the sampling port on the HIFR Rig.

Note

The CCR nozzle provided with the NHC assembly is not provisioned with a sample port. A sample must be taken from the recirculation nozzle at the flushing adapter.

5. Recirculation shall be continued until a clear and bright sample that meets both the 2 mg/l particulates and 5 ppm water limits is obtained when tested using the CCFD and FWD. A 1-quart sample of fuel will be retained at the refueling station for delivery to the helicopter if requested.
6. The system shall be depressurized but full of fuel and the hose and rig laid out on the deck as shown in Figure 6-2.
7. The entire area of the ship that is subject to helicopter rotor wash shall be inspected for the removal of all FOD.
8. All flight deck safety nets (if applicable) and other obstructions shall be lowered.
9. The helicopter shall approach the ship from the stern, hover over the HIFR "H" marking, and lower its hoist to the deck of the ship. Normally a fuel sample bag will be attached to the hoist when it is lowered.
10. Touch the grounding wand to the helicopter's hoist and keep it in touch while placing the fuel sample in the bag.

WARNING

Do not attempt to touch the hoist with the grounding wand until it has been completely lowered and is sitting on the deck. Dangerous static charges can be released when the hoist first strikes the deck or grounding wand.

WARNING

- Personnel handling grounding wand must wear appropriate insulated gloves. During HIFR of an H-53E, the individual manning the grounding wand shall wear insulated Class III, Type I (26,500 volts) rubber gloves. This individual shall not tend the fueling hose.
- Under no circumstances shall the helicopter hoist cable be secured to any part of the ship.

11. Fuel sample will be hoisted into the helicopter for inspection.
12. Helicopter crew will again lower the hoist.
13. Allow the hoist to again land on the deck before attempting to touch the grounding wand to it.
14. Attach the hoist to the HIFR saddle.
15. Aircrew will raise the hoist, connect the nozzle grounding wire to the aircraft, and connect the nozzle to the aircraft's HIFR connection. The helicopter will then move clear of the deck to port, and descend slightly.
16. Aircrewman will signal refueling crew on deck to commence fueling using appropriate signals given in NAVAIR 00-80T-113/NWP 3-04.1.

WARNING

Do not pressurize the HIFR hose prior to receiving the "commence pumping" signal from the aircrewman. A pressurized hose will prevent hookup between the nozzle and the pressure fueling port and can result in a fuel spill inside the aircraft cabin.

17. At least two ships' crewmen shall tend the fueling hose to prevent excess slack from developing in the hose. It is essential that no excess strain be placed on the hose since this may actuate the emergency breakaway device in the NHC HIFR assembly.

WARNING

All personnel shall remain clear of the area between the fuel hose and the port deck edge after the helicopter has received the fuel hose. If the hose is drawn taut, personnel in this area could be pulled overboard.

18. When fueling is complete, the crewman shall signal for the pumping to stop. The helicopter will then be repositioned over the deck and the HIFR rig will be disconnected and lowered.
19. Restow the refueling hose and HIFR rig.

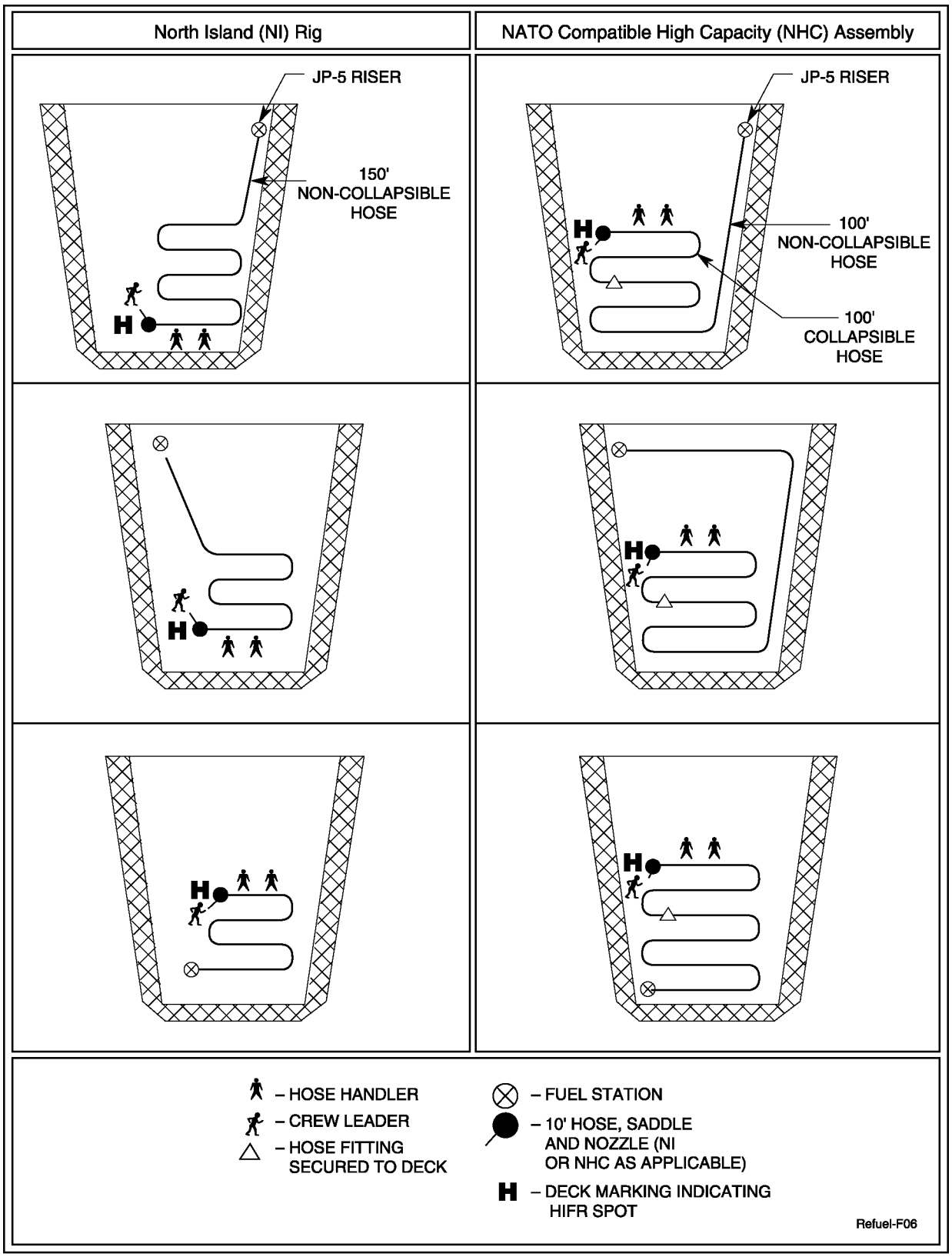


Figure 6-2. HIFR Hose Layouts

6.2.7 Refueling Aircraft with Auxiliary Power Unit (APU) Running. The aircraft APU may be used to supply electrical power for pressure refueling on military aircraft so equipped. Refueling with the APU running shall not be conducted in the hangar area. This operation is not considered "hot refueling;" however, the following precautions shall be observed in addition to the normal refueling procedures:

1. One person shall be located at the APU controls in the cockpit.
2. Hand signals/signal wands shall be established between cockpit and personnel performing refueling to ensure immediate shutdown in the event of emergency.

Note

Personnel in the vicinity of the aircraft shall wear full flight deck gear.

6.2.8 Concurrent On-Loading/Off-Loading and Refueling of Aircraft. Commanding Officers (COs) may grant authorization for concurrent refueling, cargo loading, and cargo off-loading in logistical airlift operations when minimum ground time is required to support military operations. Such authorization shall not include the loading and unloading of Class A and B explosives, but can include refueling with explosive cargo previously loaded and secured onboard.

Where concurrent refueling/loading/off-loading operations are authorized, COs shall establish stringent local regulations and procedures to ensure safety. In addition, the CO shall clearly designate one qualified person in charge of each operation.

The following procedures and precautions shall be included in the local regulations and procedures:

1. No passengers or patients shall remain onboard during concurrent refueling operations unless authorized by the CO.
2. LOX converter bottle can be exchanged but final connection shall not be made.
3. The procedures contained elsewhere in this chapter shall be followed as appropriate.

6.2.9 Defueling Aircraft. Defueling is one of the most technically demanding and potentially dangerous operations performed by fuels personnel. Most aircraft defueling equipment has the capability of defueling an aircraft faster than the aircraft can release it. The pump's effluent (discharge) shall be throttled down to balance its influent (fuel from aircraft) in order to prevent pump cavitation and/or the loss of suction, which would necessitate reflooding of the pump. Once the proper balance is achieved it must be maintained by manipulation of the valve on the downstream side of the pump throughout the defueling operation.

On CV/CVN and amphibious assault aviation ships defuelings normally have lower priority than refuelings. Unless otherwise directed and if they are not of an emergency nature, defuelings will be by written request approved by the Aircraft Handling Officer (ACHO) (does not apply to air-capable ships). A defuel request for an aircraft that is leaking fuel shall be considered an emergency and handled promptly.

The following rules apply to every defueling operation:

1. Aircraft defueling shall be requested by an authorized representative of the squadron's CO completing and submitting an Aircraft Defueling Certificate (Figure 6-3) to the ACHO.
2. During defueling operations, no other maintenance not directly required to facilitate the defueling operation is to be performed.
3. All fuel removed from turbine engined aircraft shall be assumed to be low flash point fuel. Defueled turbine fuel shall therefore not be returned to JP-5 storage tanks without first confirming the flash point of the material to be 140 °F or higher.
4. Prior to any defuel, fuel will be tested for particulates, free water, and flashpoint. Ultimate disposition will depend on the results of subsequent laboratory tests.

WARNING

Fuel with a flashpoint below 140 °F shall not be defueled into the ship's storage tank. These systems are not designed to handle fuel with a lower flash point. The risk of explosion and/or fire will significantly increase if fuel with a low flash point is placed in these systems.

AIRCRAFT DEFUEL REQUEST

Date: Time:

1. Squadron: A/C Side Number:

   Tanks to be Defueled:

   Present Fuel Weight in Tank to be Defueled:

   Discrepancy:

   Submitted by:

2. (A) Approved by:
   CVW-2 Maintenance Chief

   (B) Approved by:
   Aviation Fuels Maintenance Officer

   (C) Approved by:
   Aircraft Handling Officer

3. Fuel samples are required from ALL aircraft tanks to be defueled. Squadron REP, and AIR DEPT, and AV/FUELS REP are responsible.

   SAMPLE RESULTS:
   (A) FUEL TYPE:
   (B) FUEL QUALITY:
   (C) DATE/TIME TAKEN:
   (D) REMARKS:

   APPROVED BY:
   V-4 DIVISION QA REP.

4. DEFUEL TO BE PERFORMED BY AV/FUELS REPAIR TEAM ONLY.

   Date/Time Defuel Commenced: Completed:

   Amount Defueled:

   Remarks:

REPAIRMAN-IN-CHARGE:

Figure 6-3. Aircraft Defueling Certificate

Note

Fuel containing leak detection dye cannot be returned to a ship's system.

5. If during the defuel operation the pump starts to lose prime or cavitate, the operation will be discontinued until the problem is resolved.
6. A special log of each defueling operation shall be maintained. The following minimum information shall be contained in the log:
   a. All abnormal happenings
   b. Aircraft buno
   c. Station/portable defuel
   d. Visual/flashpoint
   e. Amount of product actually defueled vice what was scheduled to be removed; scheduled amount to have been defueled
   f. Disposition of product
   g. Time/date of the day when the defuel operation was started and completed
   h. Name of defuel operator and squadron personnel present during the defuel operation.
7. Defueling crews shall wear safety clothing and goggles.
8. Plane captains shall be at their aircraft, and aircraft engines stopped. Secure all electronic and electrical switches not required for defueling.
9. If equipped with a twin agent firefighting unit (TAU), the TAU shall be stationed upwind of the aircraft to be defueled.

6.2.9.1 Defueling with SPR Nozzle. Perform the defuel operation as follows:

1. Verify that aircraft has been grounded. If not, connect ground wire to deck and then to aircraft.

Note

Ground connections shall be made to bare metal.

2. Unreel the hard hose and lead to aircraft to be defueled.
3. Ensure quick disconnect continuity switch is in OFF (defuel) position.
4. Remove SPR receptacle cap from the aircraft.
5. Remove the dust cover from the SPR (D-1) nozzle.
6. Lift nozzle by lifting handles, align the lugs on the nozzle with the slots on the aircraft adapter and hook up the nozzle to the aircraft by pressing it firmly onto the adapter and rotating it clockwise to a positive stop.

WARNING

Nozzle must seat firmly on the adapter and not be cocked.

7. Open station defuel valve.
8. Start defuel pump or station pump as applicable.
9. Defuel aircraft as directed.
10. Rotate the nozzle flow control handle to the full open position. (The handle shall rotate 180 degrees to ensure that the poppet valve is fully open and locked by toggle action.)
11. When defueling is complete, shut the nozzle valve by rotating nozzle flow control handle 180 degrees to shut and locked position.
12. Stop defuel pump and shut defuel valve.
13. Disconnect nozzle from aircraft.
14. Replace nozzle receptacle (adapter) cap on aircraft.
15. Replace dust cover on the SPR nozzle.
16. Remove ground wire from aircraft, then metal deck.
17. Restow hose.

6.2.9.2 Defueling with Overwing Nozzle. Perform the defuel operation as follows:

Note

- If a gravity nozzle is to be used to defuel a drop tank or other similar vessel, the nozzle must first be outfitted with a short length of hose. The bottom of this hose must have notches so that suction is not impeded.
- Shipboard suction defueling of OH-58D aircraft is not possible using a section of

1-1/2″ or larger fuel hose, as those hoses are too large to fit through the aircraft's gravity fuel filler port. A defueling adapter with a smaller outer diameter hose will be required.

1. Verify that aircraft has been grounded. If not, connect ground wire to deck and then to aircraft.

Note

Ground connections shall be made to bare metal.

2. Unreel the hard hose and lead to aircraft to be defueled.
3. Ensure quick disconnect continuity switch is in OFF (defuel) position.
4. Bond the overwing nozzle to the aircraft as shown in Figure 6-1 and then remove the filler cap from the aircraft.

WARNING

Always bond the nozzle to the aircraft before the fill cap is removed. This connection shall remain in place until the entire defueling operation is complete. Failure to bond nozzle and/or maintain contact can result in a dangerous static spark inside the fuel tank.

5. Remove cap from the drop tank or other similar vessel.
6. Open station defuel valve.
7. Start defuel pump as applicable.
8. Defuel drop tanks as directed.
9. Stop defuel pump or station pump and shut defuel valve.
10. Disconnect nozzle from aircraft.
11. Replace cap on drop tank.
12. Disconnect nozzle bond wire.
13. Remove ground wire from aircraft, then metal deck.
14. Restow hose.

6.2.10 Handling of Aircraft Containing Fuel Other Than JP-5. Aircraft that have been either land-based or aerial refueled by USAF, USA, commercial airport, or other equipment/facilities shall be assumed to contain fuel other than JP-5 in their tanks. The following precautions apply:

1. Aircraft recovering aboard the ship with mixed fuels shall notify the first available ship's controlling authority (strike, marshal, PriFly/tower) prior to recovery.
2. On deck, identification of aircraft containing fuel other than JP-5 shall be as prescribed by the flight deck officer. Identification of fuel other than JP-5 shall be maintained until it has been certified that the flashpoint is 120 °F or higher. Aircraft shall be refueled with JP-5 as soon as possible.
3. Every effort should be made not to park aircraft with low flash point fuels on hot catapult tracks.
4. Prior to any defuel operation the aviation fuels officer shall ensure that the fuel being removed is of satisfactory flash point for shipboard storage.

WARNING

Fuel with a flashpoint below 140 °F shall not be defueled into ship's storage tank. Shipboard aviation fuel systems are not designed to handle fuel with a lower flash point. The risk of explosion and/or fire will significantly increase if fuel with a low flash point is placed in these systems.

6.2.10.1 Hangaring of Aircraft Containing Fuel Other Than JP-5. If, for any reason, an aircraft containing fuel with a suspected low flash point must be moved to the hangar deck, fuel samples must be taken from all low point drains of the aircraft and their flash points measured. If the flash point of any sample is found to be below 140 °F but all samples test above 120 °F, the aircraft can be lowered to the hangar deck with the following precautions:

1. All hangar bay sprinkling groups located in the hangar bay in which the aircraft are parked shall be operable.
2. An operable MFVU/TAU or other approved firefighting equipment shall be positioned at a

location that will provide coverage of the affected aircraft. (Air-capables shall provide equivalent coverage as contained in NAVAIR 00-80R-14.)

3. CONFLAG station located in the hangar bay with the affected aircraft shall be manned (does not apply to air-capable ships).

4. Hot work shall not be conducted in the hangar bay or in close proximity to the hangar bay containing the affected aircraft.

6.2.10.2 Use of Plane-to-Plane Transfer Cart to Transfer Low Flashpoint Fuels Between Aircraft. The primary method of increasing the flashpoint of fuel above 120 °F in an aircraft that has land or aerial refueled with other than JP-5 fuel is to refuel the aircraft with JP-5. If this is impractical or undesirable the preferred method of removing the fuel is to use the Plane-to-Plane Transfer Cart. This cart comprises two hose reel assemblies with SPR nozzles, an air-operated pump, two Velcon Aquacon filter units, and a deadman control. The cart belongs to the V-4 division. Requests for plane-to-plane fuel transfers shall be made from the squadron level to the ACHO via the aviation fuels officer.

6.2.10.2.1 Procedures. The purpose of the Plane-to-Plane Transfer Cart (Figure 6-4) is to safely transfer low flashpoint fuel and fuel suspected of containing thermal stability additives between aircraft.

1. Submit approved fuel transfer request to the aircraft handling officer and fuels officer. See Figure 6-5.

WARNING

- Hot refueling of aircraft using the Plane-to-Plane Transfer Cart is not authorized.
- Engines of aircraft involved in fuel transfer shall not be started while hoses are connected to aircraft.

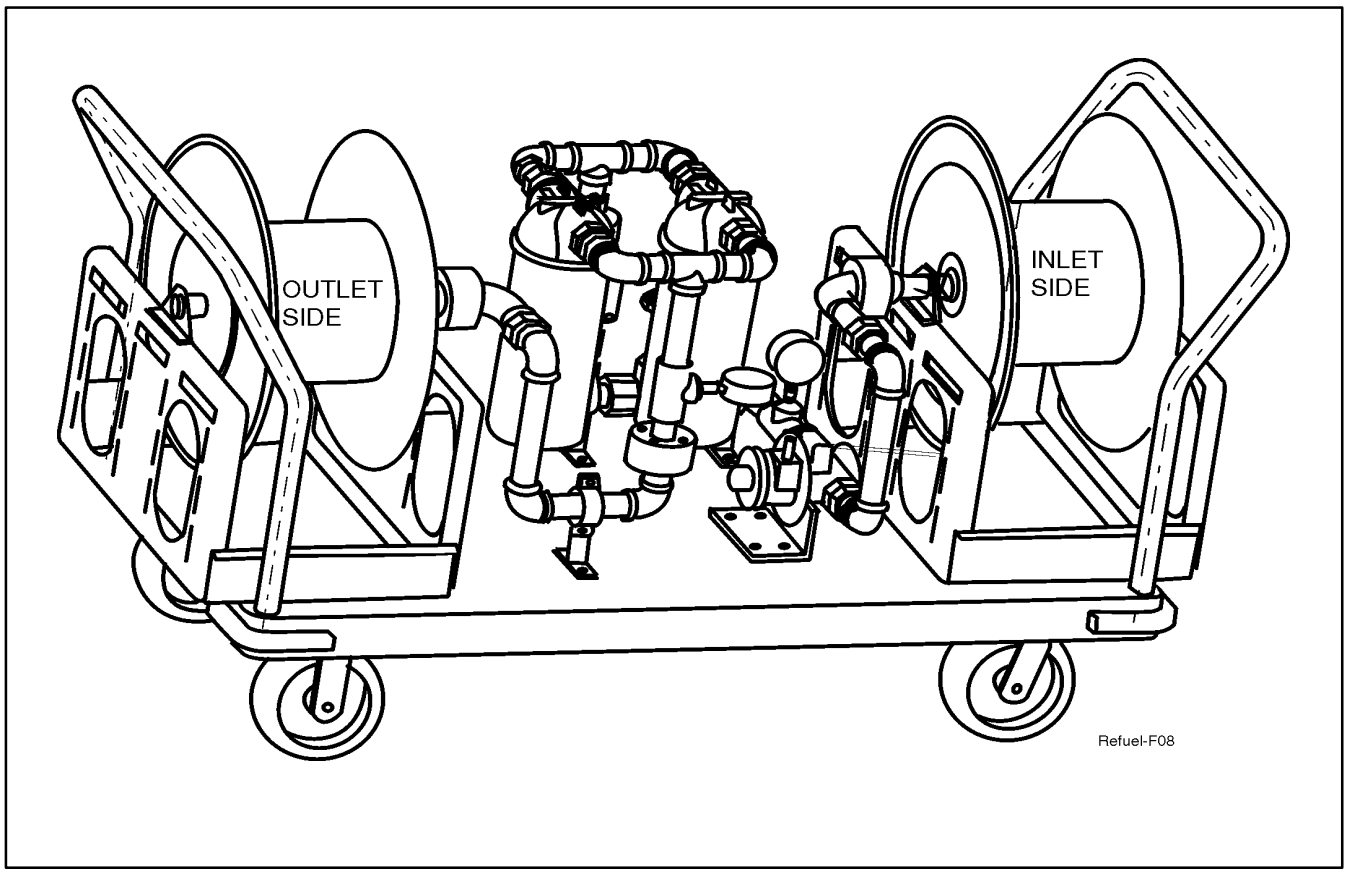


Figure 6-4. Plane-to-Plane Transfer Cart

Date: _____ Time: _____

1. Squadron: _____ A/C Side Number: _____

   Tanks to be Defueled: _____

   Present Fuel Weight in Tank to be Defueled: _____

   Maintenance Discrepancy: _____

   Receiving Aircraft Side Number: _____

   Present Fuel Weight of Receiving Aircraft: _____

2. (A) Approved by: _____
   CVW-2 Maintenance Chief

   (B) Approved by: _____
   V-4 Maintenance Officer

   (C) Approved by: _____
   Aircraft Handling Officer

3. Fuel samples are required from ALL aircraft tanks to be defueled. Squadron REP, and AIR DEPT, and AV/FUELS REP are responsible.

   SAMPLE RESULTS:
   (A) FUEL TYPE: _____
   (B) FUEL QUALITY: _____
   (C) DATE/TIME TAKEN: _____
   (D) FLASHPOINT: _____
   (E) LOW POINT DRAINS VISUAL INSPECTION: _____
   (F) REMARKS: _____
   APPROVED BY: _____
   V-4 DIVISION QA REP.

4. TRANSFER OPERATION TO BE PERFORMED BY QUALIFIED TRANSFER CART TEAM ONLY

   Date/Time Transfer Commenced: _____ Completed: _____

   Amount Transferred: _____

   Flash Point of Receiving Aircraft upon Completion _____

   Remarks: _____

Figure 6-5. Aircraft-to-Aircraft Mixed Fuel Transfer Certificate

WARNING

Defueling of aircraft into the ship's fuel storage system using the Plane-to-Plane Transfer Cart is not authorized.

Note

- Ensure issuing and receiving aircraft are positioned close to each other.
- Ensure aircraft are securely chocked and tied down.
- Ensure all aircraft electrical and electronic switches not required for the transfer operation are turned off.
- Ensure aircraft low point drains have been drained of water and solids prior to commencing transfer operations.

2. Conduct fuel flash point test on issuing aircraft, and record results.
3. Verify that all maintenance requirements for transfer cart and components are current. Inspect low pressure air manifold lubricator for proper oil level.
4. Securely connect low pressure air hoses and fittings between air supply outlet and transfer cart inlet manifold.
5. Position transfer cart between aircraft.
6. Secure and ground cart to deck.
7. Ensure mobile firefighting unit is present.
8. Inspect and verify area is free of open flames or spark-producing devices.
9. Ensure transfer detail and plane captains are present.
10. Inspect nozzles and quick-disconnect couplings for secure fit prior to attaching to aircraft.
11. Unreel and inspect entire length of suction and discharge hoses. Verify hose integrity.
12. Visually inspect aircraft adapters for any damage or significant wear. Attach nozzles and grounding wires to each aircraft.

WARNING

Ensure that nozzle is seated firmly on the adapter and is not cocked.

13. Inspect nozzles and aircraft receptacles for leakage.
14. Open air supply outlet valve.
15. Open transfer cart air manifold valve.
16. Verify air pressure is sufficient. (Adjust air pressure via regulator to 80 psi; not to exceed 100 psi.)
17. When both nozzle operators and plane captains are ready, open nozzle flow control handles to the FULL OPEN position. Handles shall rotate 180 degrees to ensure that the poppet valve is fully open and locked.
18. Deadman operator activates deadman to commence transfer operation.
19. When directed by the plane captain, deadman operator will release the deadman to stop the transfer operation.
20. When the transfer operation is completed, rotate the nozzle's flow control handles into the OFF and fully locked position.
21. Remove nozzles from aircraft, stow hose, disconnect cart from air supply, and stow cart in designated location.

6.2.10.2.2 Taking of Fuel Samples During Fuel Transfer Operation. During the fuel transfer operation, take fuel samples as follows:

1. From the nozzle attached to the receiving aircraft after flow is established
2. From the low points of the receiving aircraft after the transfer operation is completed.

These samples should be tested for visual appearance. Samples from the lowpoints of the receiving aircraft should also be tested for flashpoint, free water, and particulates. Results of these tests should be entered in a locally produced fuel transfer surveillance log.

6.2.11 Handling NATO F-37 (JP-8+100) Fuel. NATO F-37 (JP-8+100) is NATO F-34 (JP-8) which has been additized with a thermal stability improving additive. The thermal stability additive is a dispersant/detergent that:

1. Disarms filter-coalescer elements

2. Adversely affects the ability of centrifugal purifiers to remove free water and sediment from aviation turbine fuel

3. Makes free water readings taken with the AEL Free Water Detector (a component of the CCFD) and the Aqua-Glo Free Water Detector unreliable.

USN/USMC aircraft are not authorized to use NATO F-37. It is possible that USN/USMC aircraft may receive NATO F-37 inadvertently when conducting joint operations requiring refueling from ashore air stations operated by NATO member air forces that utilize NATO F-37.

Note

NATO F-37 is not authorized for use in USAF or other NATO member nations' aerial refueling aircraft.

If aircraft are suspected of having received NATO F-37 and need to be defueled, the following handling procedures, in addition to those contained in paragraphs 6.2.10 and 6.2.10.1, apply:

WARNING

Do not, under any circumstances, place NATO F-37 in a ship's aviation fuel storage/delivery system.

1. Use plane-to-plane transfer cart to transfer NATO F-37 fuel between aircraft.

2. If a plane-to-plane transfer cart is unavailable, NATO F-37 fuel shall be treated as hazardous waste and handled accordingly.

Aircraft which are suspected of having received NATO F-37 fuel from any source are safe for defueling directly to ships aviation fuel storage tanks only after refueling three times with a full usable internal fuel load of NATO F-44 (JP-5).

TYCOMs and AIR-4.4.5 shall be notified via naval message of any actual/suspected NATO F-37 defueling.

CHAPTER 7

Shipboard Preventive Maintenance

Ship's personnel shall follow appropriate OPNAV, NAVSEA, and TYCOM Manuals and Instructions for equipment and systems maintenance.

CHAPTER 8

Organization and Training at Shore Activities

8.1 ORGANIZATION

The effectiveness of any complex operation is dependent on a well-structured organization with qualified and knowledgeable supervision. The cost of fuel, fuel facilities, and equipment and hazards of fuel operations are a few of the critical factors that shall be considered in the development of a fuel organization. It is these factors coupled with the essential part aircraft refueling plays in flight operations that justifies Division status for the integrated fuel operation.

Navy and Marine Corps shore activities are urged to use the standard organization for integrated fuel operations shown in Figure 8-1. At Government Owned Contractor Operated (GOCO) Facilities the standard organization chart shown in Figure 8-2 should be used.

The allowances for a Fuel Division should include personnel in adequate quantities and with sufficient grade structure, training, and seniority to ensure responsible operation of facilities and equipment in response to the maximum projected operational demand. Navy personnel with the Aviation Boatswain's Mate Fuels (ABF) rating and civil service (shore facilities) personnel allowances should be primarily validated and documented based on past experience. The airfield's classification, aircraft base loading (including any planned changes), and general daily tempo of operations must also be considered.

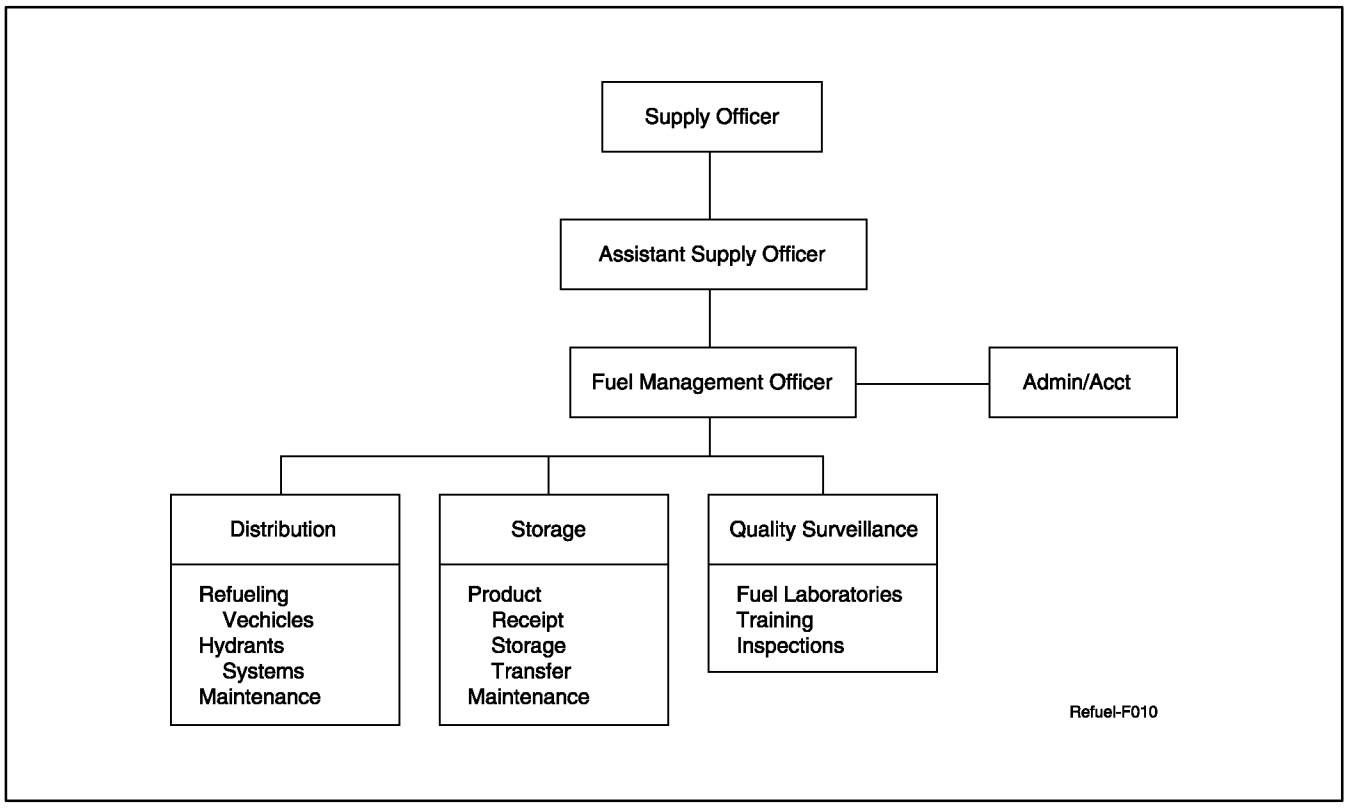


Figure 8-1. Typical Shore Activity Organization

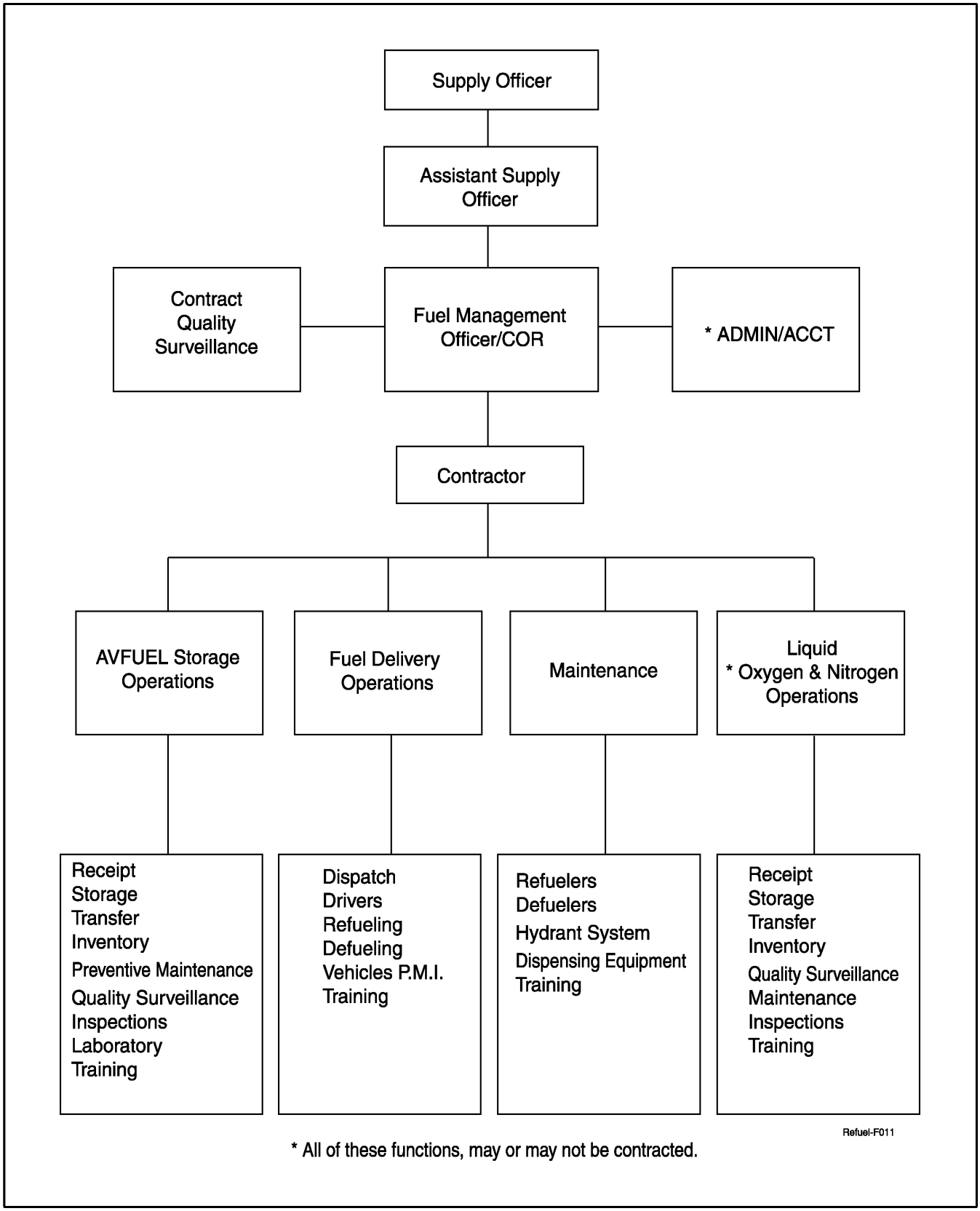


Figure 8-2. Typical Government Owned Contractor Operated Facility

The organization should be flexible enough to efficiently handle increased workload on short notice. This can best be accomplished by cross-training and cross-manning; i.e., truck refueler driver/operators should also be trained to operate direct refueling stations. Leave schedules and school attendance can be adjusted to accommodate workload peaks. Lengthening working shifts (recommended not to exceed 10 hours) and nonstandard duty sections, including standby duty section assignments, should be last-resort measures.

The functional heads (Fuel Management Officer (FMO) and Assistant Fuel Management Officer (AFMO)) of the integrated fuel operations shall:

1. Possess broad fuel background and experience; e.g., formal training and experience in the technical area of fuel operations and handling

2. Be full-time primary assignments

3. Be graded positions, if civilian

4. Carry delegated authority commensurate with responsibility

5. Report directly to the Supply Officer at shore facilities.

8.1.1 Responsibilities. At shore activities the Supply Officer is responsible for budgeting, receipt, storage, accountability, issue, quality assurance, and environmental impact of petroleum products. General, preventive maintenance of petroleum oil lubricants (POLs) handling, storage, and delivery systems is an integral part of this responsibility.

The FMO discharges the Supply Officer's fuel responsibilities through the planning, directing, training, and supervision of a completely integrated fuel operation.

Aircraft custodians are responsible for training nozzle operators, aircraft directors, and fire watches for aircraft refuelings and defuelings. The nozzle operator shall assist the refueler operator in handling the hose and nozzle prior to, and after the servicing of aircraft in order to minimize hose wear and nozzle damage due to dragging.

Note

Transient aircraft will be refueled by personnel identified by local instruction in compliance with this directive.

Air Operations Officer is responsible for establishing priorities for aircraft fuel delivery services. In addition, shore activity Air Operations Officers are responsible for providing input to the activity's fuel instruction pertaining to operating procedures on the parking aprons and ramp areas, aviation safety, and any peculiar requirements for unique, seldom handled, or new aircraft.

The FMO is responsible for identifying, to the Public Works Officer (PWO) or other appropriate official, all corrective repair actions that must be accomplished on fuel facilities, systems, and equipment by personnel outside of the immediate fuels organization. The FMO must also develop and coordinate, with the appropriate activity official(s), a preventive maintenance program that addresses all fuel storage facilities and dispensing equipment including tanks, fill stands, piping valves, pumps, electrical installations, and mobile and fixed refuelers. Grass cutting and general area maintenance around the fuel farm in all but the hazardous areas, around fuel vents, and fenced areas, must also be coordinated with the appropriate official. It is also the FMO's responsibility to initiate and monitor necessary military construction and other fuel related projects by submitting them to the PWO or other appropriate activity official.

The PWO/Environmental Officer/Hazardous Material Officer is responsible for coordinating oil spill cleanup with fuel personnel.

8.1.2 Duties. Refer to MIL-HDBK-844(AS) for a detailed discussion of the various specific duties of the FMO, AFMO, and other officers and personnel of the fuel division.

8.2 TRAINING REQUIREMENTS

8.2.1 General Training Requirements. It is essential to the safety of fuel handling operations that personnel be properly trained. At least one fully trained and qualified individual will be involved in all fuel handling operations. The use of Temporary Additional Duty (TAD) personnel shall be kept to an absolute minimum.

All Contracting Officers' Representatives (CORs) shall be properly trained and qualified in contract administration. As a minimum, all CORs shall receive 80 hours of formal classroom instruction prior to assuming COR duties and responsibilities. Contact NAVPETOFF for recommended courses and training.

Contractor employees performing fuel duties shall be company trained and certified. Certification shall include a written or oral examination as well as direct observation of the employee performing the certified duties. Records of training and certifications shall be maintained. The COR shall verify that training and certification have been accomplished.

All personnel shall be trained via the following minimum steps:

1. An informal course in which the contents of this manual, MIL-HDBK-844(AS), NAVFAC MO-230, and NAVSUP P-558 are taught. The course shall be developed to emphasize safety and procedural requirements contained in these manuals and how they apply to the local facilities, equipment, and operations. Personnel shall be required to demonstrate their acquired knowledge.

2. A series of apprenticeship programs (on-the-job training (OJT)) for each major system to be operated; for example, direct refueling system, refueling truck, truck fill stand, and fuel transfer system. The novice operator shall be instructed on the system's operation using the operating instruction manuals. Afterward, a certified, experienced operator shall demonstrate the system's operation to the novice. The student shall then operate the system under the supervision of an experienced operator who will ultimately certify that the student has acquired the knowledge necessary to correctly and safely operate the system. The length of time each apprenticeship program takes will depend on the complexity of the system being taught as well as the abilities of the student. All activities are required to maintain a formal document that outlines the apprenticeship program covering each major system. This outline must contain details on instructional materials used (operating manuals and local operating instructions) as well as the minimum experience (time) requirements for obtaining certification. As a minimum, these apprenticeship programs should follow the PQSs for Fuel Operations Ashore, NAVEDTRA 43288. This will assist each student in establishing long- or short-term goals for qualifications.

All drivers of refueling or defueling vehicles shall attend an airfield indoctrination course as outlined in NAVAIR 00-80T-114.

8.2.2 Refueling Vehicle Operator Certification. Active duty military and civil service drivers shall carry a current Optional Form 346 (OF-346) U.S. Government Motor Vehicle Operator's Identification Card and comply with the requirements delineated in NAVFAC P-300, Management of Transportation Equipment. In addition, driver training and certification must comply with all applicable local, state and Federal laws. DoD contractor personnel assigned to operate either government owned/leased motor vehicles shall be certified by the contractor as being fully qualified to operate the vehicles. As a minimum, drivers shall be licensed for the class vehicles they are operating and shall comply with the licensing requirements of the local activity.

8.2.3 Nozzle Operators' Training and Certification. Nozzle operators shall be thoroughly trained and certified in accordance with the applicable directives for the type, model, and series of aircraft being refueled. This training shall result in the nozzle operator possessing a thorough working knowledge of the aircraft's fuel system including the following specific items:

1. Aircraft's ground refueling panel

2. Precheck system

3. Location and operation of any switches that control the flow of fuel into the various tanks of the aircraft

4. Locations of the aircraft's fuel system vents

5. Mechanism(s) by which the pressures within aircraft tanks must be monitored (to prevent overpressurization)

6. Mechanism(s) by which the tank loading status (e.g., full, partial, no load) can be monitored.

CHAPTER 9

Quality Surveillance of Aviation Fuels at Shore Activities

9.1 GENERAL REQUIREMENTS

The major objective of fuel handling personnel is to deliver clean, dry, and correct fuel to aircraft. The fuel systems of modern aircraft are complex and will not function properly if fuel is contaminated with dirt, water, or other foreign matter. In addition, aircraft engine failure or poor performance may also be caused by incorrect fuel or by contamination of the proper fuel with other petroleum products or materials. Refer to MIL-HDBK-844(AS) for a detailed discussion of the various types of fuel contaminants, their effects on the using equipment, and their possible sources.

The quality surveillance of aviation fuels is a continuous process. Every action such as transferring product from one tank to another or short-term storage in a poorly coated tank can introduce contaminants into the fuel. All local operating procedures shall therefore be written with this fact in mind. Sources of contamination must be recognized and eliminated. In addition, procedures must be in place to routinely monitor the quality of the fuel so that the presence of abnormal amounts of contaminants is identified and steps are taken to remove them.

The Defense Logistics Agency and its field activity, the Defense Fuel Supply Center, have designated the fuel quality control efforts performed at the refinery or time of fuel purchase as “quality assurance.” All fuel quality control efforts performed after the fuel has been delivered to the Government are classified as “quality surveillance.” This chapter conforms to this policy.

This chapter outlines the absolute minimum steps that shall be taken in order to:

1. Monitor the quality of the fuel being handled and delivered to aircraft.

2. Control and minimize the introduction of typical contaminants (water and particulates).

The detailed operating procedures contained in Chapter 12 and the maintenance procedures of Chapter 13 incorporate many of these monitoring and quality surveillance steps. Any local operating instructions for specific systems or pieces of equipment shall also contain appropriate quality surveillance procedures.

9.2 AVIATION FUEL QUALITY SURVEILLANCE PROGRAM

All activities that refuel aircraft shall establish a formal fuel quality surveillance program. Samples shall be taken from the refueling nozzle of each aircraft refueling system, vehicle, truck fill stand, etc., and tested using the CCFD and FWD. Visual inspections shall also be taken for spot checks. All activities shall record all test results in a log, similar to Figure A-1 in Appendix A, along with the date, approximate time, the source (tank, refueler filter/separator, refueling nozzle, etc.) and other appropriate information. This shall be done for visual as well as machine run tests. Such records shall be used to monitor equipment performance as well as to provide an audit trail.

The following paragraphs establish the minimum sampling and testing requirements for aviation fuels. They shall be treated as the minimum requirements and shall not preclude more frequent or extensive testing should contamination be suspected. MIL-STD-3004, contains analogous information regarding fuel sampling and testing requirements. This handbook is produced jointly by the Defense Energy Support Center and the three Services to provide instructions and guidance on the handling and testing of fuel within the Defense Logistics Agency’s supply and distribution system. In the event of a conflict between the requirements of this NATOPS Manual and MIL-STD-3004, this NATOPS Manual takes precedence.

9.2.1 Fuel Receipts. The following paragraphs contain the absolute minimum tests that shall be performed when receiving fuel at a shore activity.

WARNING

If for any reason it is suspected that the product being received has been significantly contaminated with other fuels, petroleum products, or other materials, a special sample shall be taken and a complete set of fuel specification tests shall be performed. Failure to identify and reject contaminated fuel can negatively affect aircraft safety-of-flight.

In addition to the routine samples that are immediately tested during fuel receipt, shore activities shall obtain a 1-gallon retention sample that is representative of the shipment. This sample shall be tagged, logged, and stored in an approved flammable storage cabinet and retained for 60 days or until one of the following conditions occur:

1. The product represented by the sample is consumed
2. The product becomes nonrepresentative of the sample held.

9.2.1.1 Fuel Received by Tank Car or Tank Truck at Shore Stations. Ensure that seals are intact and that the numbers correspond to those on the shipping document. After connections with receiving system have been made and fuel flow initiated, immediately take a sample from the manifold or coupling (nozzle) and conduct the following tests:

1. Color
2. Appearance
3. API gravity.

If the product is clear and bright in appearance and the API gravity is within 0.3 degrees of the shipping document (DD Form 250, Material Inspection and Receiving Report, or delivery invoice), receipt of the product shall be continued. A second sample shall then be taken and tested for:

1. Particulates (visual)
2. Free water (visual)
3. Flash point (JP-5 and JP-8 fuels only)
4. FSII (turbine fuels only).

An alternate procedure is to take an all-levels sample and conduct the above tests prior to initiating fuel flow.

If either manifold sample fails the test requirements, product receipt shall be halted and an all-levels sample shall be obtained from the tank car or tank truck compartment. In the case of excessive particulates or free water, the all-levels sample shall be tested using the CCFD and/or FWD as appropriate. If the resample contamination exceeds 2 mg/l solids or 5 ppm water and the product must be received, additional sampling and testing will be required downstream of the tank and filter separator to ensure that contamination is reduced to acceptable levels through settling and filtration. If a repeat flash point failure occurs, notify the FMO and the Quality Assurance Representative (QAR) at the point of origin.

Note

In the case of compartmented vessels, all-levels samples shall be taken from each compartment.

For multiple receipts by tank car and tank truck from the same supplier, the same source (tank), and the same vessel (truck/tank car), only the first delivery of the day need be tested for flash point and a retention sample kept.

9.2.1.2 Fuel Received by Pipeline at Shore Stations. A line sample will be taken 1 minute after flow commences and checked for color, appearance, and gravity. If the product is clear and bright in appearance the flow will continue. The receiving tank will be segregated until further sampling and testing can be accomplished. An all-levels sample or a composite of upper, middle, and lower samples will be used. Receiving tank samples will be tested as follows:

1. Color
2. Appearance
3. FSII (all turbine fuels only)
4. Flash point (JP-5 and JP-8 only)
5. API gravity

6. Particulates by CCFD or gravimetric method

7. Free water by FWD.

9.2.1.3 Fuel Received by Barge or Tanker at Shore Stations. Before discharge from the vessel is commenced, an all-levels sample will be taken from each tank and tested as follows:

1. Color

2. Appearance

3. FSII (all turbine fuels only)

4. Flash point (JP-5 and JP-8 only)

5. API gravity

6. Particulates by CCFD or gravimetric method

7. Free water by FWD.

9.2.2 Fuel in Storage Tanks at Shore Stations. Fuel tanks must be kept as clean and dry as possible. Inactive tanks shall be gauged once a week with water-finding paste. When water is found it shall be drained as soon as possible.

Once each month, a bottom sample shall be taken from each tank to determine the presence of undetected water and to measure bottom sediment levels.

Fuel stored for long periods of time shall be sampled and fully tested in accordance with the applicable specification each 6 months for turbine fuels and each 6 months for aviation gasoline. Should any fuel approach the deterioration use limits (Appendix B) within these time periods, testing frequency shall be increased to assure that fuel quality is maintained. Such fuel shall also be rotated and consumed as soon as possible.

9.2.3 Fuel Issued to Aircraft. Fuel in refueler trucks, direct fueling stations, or other shore-based equipment used to dispense fuel directly into aircraft shall be recirculated (flushed) through the equipment/system's hose and refueling nozzle and back to a fuel tank prior to the first refueling of the day. During recirculation the fuel shall be sampled at the nozzle and tested for:

8. Color (visual inspection)

9. Appearance (visual inspection)

10. Free water (CCFD/FWD or equivalent)

11. Particulates (CCFD or equivalent).

Note

- A minimum of two samples are required when running both a particulate and free water test (one for each test). Fuel that has been tested for particulates, free water, or FSII shall not be reused to run any other test since this practice could lead to inaccurate results.

- If a refueling facility's risk assessment conducted in accordance with OPNAVINST 3500.39 indicates that there is a low probability of particulate and water contamination entering the fuel distribution system, then the responsible TYCOM may authorize the substitution of a visual inspection in place of the requirements of steps 10 and 11 above. If visual inspections for free water and particulates are authorized, then at least once every 7 days activities shall test samples from each in service refueling system for free water and particulates using the CCFD. If the activity has a CFD instead of a CCFD, then the sample shall be tested for free water using the FWD.

- If a refueling facility has an operating receipt filter (filter-coalescer or micronic) prior to its bulk storage tanks or an operating two stage filter/separator vessel prior to its day (service) tanks; and either a two-stage filter/separator vessel followed by a monitor vessel or a three stage filter/separator/monitor vessel at the truck fill stand or prior to a direct refueling station, then a facility risk assessment is not required and a visual inspection may be substituted for the requirements of steps 10 and 11 above. When visual inspections are substituted

for the requirements of steps 10 and 11, then at least once every 7 days samples from each in service refueling system shall be tested for particulates and free water using the CCFD (or equivalent).

Recirculation (flushing) and testing are required on all in-service refueling equipment/systems once during every 24-hour period.

Shore activities shall, at a minimum, conduct monthly spot checks of FSII levels in each storage tank and each piece of mobile refueling equipment. Testing shall be conducted using the B/2 Anti-Icing Test Kit.

9.2.4 Routine Correlation Sampling and Testing. Each activity shall take a series of routine, duplicate correlation samples to verify that in-house testing procedures and equipment are working properly. The results from this sampling/testing program are used by the TYCOMs and SYSCOMs to monitor the general quality of fuel loaded into aircraft.

The exact number of routine duplicate correlation samples drawn, shipped and tested each month by each shore station depends upon the number of CCFDs and B/2 Anti-Icing Refractometers the activity possesses. As an absolute minimum, each activity shall draw one set of duplicate samples (two 1-quart bottles) for each CCFD and one set (two 1-quart bottles) for each B/2 anti-icing refractometer. Take and process each duplicate set of samples as follows:

1. Randomly select a direct refueling system, refueler truck, and so forth.

2. Extract two 1-quart samples, one immediately after the other, from the refueling nozzle of the system while it is being recirculated or flushed.

3. Take both samples back to the activity's laboratory.

Note

If more than one set of duplicate samples are being taken at one time, appropriate steps must be taken to assure the source of each set of samples can be positively identified.

4. Test one of the samples using either the CCFD or B/2, as appropriate, and record the results in a log (see Figures A-2 and A-3).

5. Complete a fuel sample label (see Figure A-4) and attach it to the second (duplicate) sample. The results obtained using the CCFD or B/2 shall be entered on this label.

6. Ship the labeled, second (duplicate) sample to a regional fuel testing laboratory (see Appendix B of MIL-HDBK-844(AS) for a list of laboratories) for testing of the particulates (using the ASTM D 2276 gravimetric method) or FSII as indicated on the sample's label.

7. When results from the regional laboratory are received, enter them into the appropriate log next to the result obtained using the activity's CCFD or B/2 Test Kit. Compare the two results on the duplicate samples to verify the accuracy of the CCFD or B/2 Test Kit.

Aircraft refueling activities (NASs, NAVAVNDEPOTs, etc.) that routinely perform the gravimetric test method for sediment (ASTM D 2276), rather than the CCFD, are not required to send correlation samples to a regional laboratory; however, such activities are not exempt from the reporting requirements of paragraph 9.7.3. As a minimum, they shall forward a quarterly report showing at least four sediment and two FSII test results on random fuel samples extracted from aircraft refueling nozzles.

9.3 SAMPLING PROCEDURES

Proper sampling of petroleum products is as important to quality surveillance as proper testing. Improper containers and poorly-drawn or mishandled samples can cause laboratory results to be meaningless, or worse, misleading.

Directions for sampling cannot be made explicit enough to cover all cases. Judgment, skill, and experience should supplement any group of instructions. Consequently, the person assigned to take samples shall be trained, experienced, competent, and conscientious. The responsibility for taking and preparing samples shall not be lightly delegated.

This section provides general information on petroleum sampling techniques and practices. For more detailed information and instructions, including descriptions of the various types of samples (e.g., all-levels, bottom, composite, etc.), consult ASTM Standard Practice D-4057, which is available from the Standardization Documents Order Desk.

9.3.1 General Rules

1. The sampler's hands shall be clean.

2. Sample containers, clear glass quart bottles or LDPE/HDPE plastic bottles, shall be meticulously cleaned (washed with an appropriate laboratory detergent). Wipe bottles clean with lint-free cloths (i.e., MIL-C-85043 Type II).

Note

Alcohol shall not be used to clean sample bottles.

3. Samples shall be representative of the product being sampled. Samples shall be taken with the system operating at normal flow rates and steady state. Samples drawn during static (no flow) conditions are not representative of the full fuel flow and will give false results.

4. Samples shall be capped promptly, protected from light, and handled expeditiously.

5. Samples taken for shipment to shore laboratories shall be taken only in 1-quart glass sample bottles. Glass sample bottles for shipment to shore laboratories shall be filled to 1 inch below the cap.

6. LDPE/HDPE plastic bottles are authorized for use for the collection of particulate and free water fuel samples.

7. LDPE/HDPE plastic bottles shall be marked for the appropriate level (800 ml or 500 ml) and filled only to this mark.

8. Samples taken to test filter/separator efficiency shall be taken at the filter discharge.

9. Visual samples shall be taken in clear glass bottles only.

9.3.2 Sample Containers. The following fuel sampling bottles, containers, kits and safety cans are available through the supply system and are the only type authorized for the collection, retention, and submission of aviation fuel samples.

1. Kit, Fuel Sampling. A complete kit consisting of metal shipping container, cushioning material (inner-pack), and four 1-quart sample bottles, NSN 8115-00-719-4111.

2. Cushioning Material. Replacement top/bottom packing material for the above fuel sampling kit, NSN 8115-00-719-4825.

3. Replacement Kit. Replacement bottles and tags for the above fuel sampling kit, NSN 8115-00-717-8572.

4. Container, Fuel Sample. A 1-gallon, 24-gauge steel, epoxy resin lined fuel sample can suitable for the shipment or retention of fuel samples, NSN 8110-00-128-6819.

5. Drum, Shipping and Storage. A 5-gallon, 24-gauge steel, epoxy-lined fuel sample container suitable for shipment or retention of fuel samples, NSN 8110-00-400-5748.

6. Bottles, Glass, Clear. Six 1-quart clear glass bottles (without tags) suitable for taking visual samples and for shipping fuel samples to shore laboratories, NSN 8125-00-378-9994.

7. Bottles, LDPE/HDPE Plastic. Plastic bottles suitable for taking particulate and free water samples are available in two sizes:

   a. 1000 ml, NSN 6640-01-300-3541 (6 bottles)

   b. 500 ml, NSN 6640-01-461-1016 (12 bottles)

8. Container, Safety Can. Containers for the safe storage and transport of used fuel are available in two sizes:

   a. 1 gallon, NSN 7240-00-177-4999

   b. 5 gallon, NSN 7240-00-178-8286

9.3.3 Identification of Sample. All samples sent to a fuel testing laboratory shall be individually tagged with a label (see Figure A-4) containing the following minimum information:

1. The originating activity's name and address. A point of contact and phone number should be included.

2. Sample serial number (sampling activity's designation assigned to this particular sample)

3. Type fuel

4. Date sample was taken

5. Approximate time the sample was taken

6. The source of the sampling point (nozzle sample, refueler number, or tank number)

7. Name of the person who drew the sample

8. Classification of sample and tests required (See paragraph 9.2.4).

   a. ROUTINE Correlation (insert CCFD or B/2 results in space provided).

   or

   b. SPECIAL (list tests required and/or pertinent remarks. This is especially important when sending in special samples. The comments will assist laboratory personnel in determining what additional tests should be performed).

9.3.4 Sample Classification. All samples shipped to a fuel testing laboratory shall be classified either ROUTINE Correlation or SPECIAL.

9.3.4.1 Routine Correlation Sample. Routine Correlation samples are the samples taken when no fuel problems or aircraft problems attributable to fuel are known or suspected (see paragraph 9.2.4). These samples and their test results serve two purposes:

1. They assist the activity in monitoring and the performance of their local fuel testing equipment and methods.

2. They provide TYCOM and SYSCOM cognizant offices with information on the general quality of the fuel delivered to aircraft and the performance of the fleet's quality control equipment (CCFDs and B/2s).

As a minimum, these routine correlation samples are sent once a month; however, this does not preclude sending correlation samples more frequently if concerns arise about the results being obtained with local equipment.

9.3.4.2 Special Sample. Special samples are submitted for testing because the quality of the fuel is suspect either as the result of aircraft malfunctions or for other reasons. Special samples have the highest priority in handling, testing, and reporting.

9.3.5 Shipping Instructions. Samples are to be forwarded to appropriate testing laboratories by the most expeditious means. A listing of military petroleum laboratories is included in MIL-HDBK-844(AS).

Wherever feasible, samples shall be delivered directly to the laboratory by special courier.

Samples to be shipped by military aircraft shall be packed in accordance with the requirements of the manual on Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft (AFM 7l-4/TM 38-25O/NAVWEPS 15-03-500/MCO P4030.19). The sampling kit listed in paragraph 9.3.2 above meets these requirements.

WARNING

New sample bottle caps shall be used for all samples in this sample kit.

9.4 FUEL LABORATORY, TEST EQUIPMENT, AND METHODS

9.4.1 Laboratory. Each activity that refuels aircraft shall have a designated laboratory where in-house inspections and tests can be performed in a clean, safe environment. Paragraph 11.10.5 contains the minimum requirements for a fuel laboratory.

Laboratories with a broader mission and more extensive testing capability will be configured to handle the quantities and types of materials that can be expected to be encountered in such an operation.

9.4.2 Testing Equipment. The following test equipment is authorized for the in-house testing of fuel samples:

1. Combined Contaminated Fuel Detector (CCFD). This instrument is used to analyze the particulate contamination in a sample of fuel. Currently, the only CFD being procured is the CCFD, NSN 6640-01-013-5279, which includes a built-in

FWD Viewer Kit. The regular CFD, NSN 6630-00-706-2302, is still available and may be used; kits are available to convert to a CCFD by adding a FWD portion as part of an upgrade/repair. Additional materials needed to conduct tests:

a. Filter Element, Fluid, 0.65 micron — NSN 6630-00-877-3157

b. Filter, Wratten — NSN 6630-00-849-5288

Note

- Currently the only authorized (I-level) conversion/repair activity is Ships Intermediate Maintenance Activity (SIMA). Requests for conversion/repair of CCFD units should be forwarded to Commanding Officer, Ships Intermediate Maintenance Activity, Readiness Support Group, Naval Station Norfolk, VA with work request deficiency documentation and DD Form 1149 funding documentation for necessary conversion/repair parts.

- Shore Activities may use the gravimetric procedure specified in ASTM D 2276 as an alternate method of measuring particulate contamination. Consult the ASTM test method for details on the equipment and materials needed to perform this test.

2. Viewer Kit, Free-Water Detector (FWD) (NSN 6640-00-999-2786). This instrument is used to determine the free-water content of aviation fuels. Additional materials needed to conduct tests:

a. Detector Pad, Free Water — NSN 6640-00-999-2785

b. Standard, Free Water — NSN 6640-00-999-2784

Note

Since free-water standards deteriorate with exposure to ultraviolet light, they shall be changed and dated every 180 days.

3. The B/2 Anti-Icing Test Kit or FSII Refractometer, NSN 6630-01-165-7133. This device is used to determine the FSII content of aviation fuels.

4. API Hydrometers and a 1,000-ml clear, plastic, or glass graduated cylinder. These shall be used to determine the specific API gravity of the fuel.

a. Hydrometer, graduate 29- to 41-degree range, JP-5/8, NSN 6630-00-242-9258

b. Hydrometer, graduate 39- to 51-degree range, JP-5/8, NSN 6630-00-245-8376

c. Hydrometer, graduate 49- to 61-degree range, JP-4 and MOGAS, NSN 6630-00- 245-8377

d. Hydrometer, graduate 59- to 71-degree range, JP-4 and MOGAS, NSN 6630-00- 245-8374

5. Flash Point Test Equipment. This equipment is used to determine the flash point of a fuel sample. It is absolutely essential that all activities possess one of the following instruments, since any fuel removed from an aircraft and destined for storage must have its flash point tested in order to determine its disposition.

a. Pensky-Martens closed cup flash point tester, NSN 6630-00-530-0987. (This equipment requires use of a propane cylinder.)

b. Electronic flash point tester (NAVIFLASH), NSN 6625–01–472–6783. (Requires N-Dodecane for calibration.)

c. N-Dodecane Calibration Standard, NSN 6810-01-419-2677 (for use with electronic flashpoint tester).

9.4.3 Test Methods. Instructions for performing the appearance or visual test, the backbone of any fuel quality surveillance program, are contained in paragraph 9.5.1. General instructions and procedures for conducting tests with the equipment listed in paragraph 9.4.2 are contained in MIL-HDBK-844(AS). Specific, detailed instructions, however, are contained in the operating manuals provided with each test instrument at the time of procurement. Replacement copies of these manuals maybe obtained from NAVAIR AIR-4.4.5.

9.5 INTERPRETATION OF TEST RESULTS

To be acceptable for delivery to aircraft, aviation fuel must be clear and bright and contain no visually detectable free water.

WARNING

Personnel fueling aircraft shall cease fueling operations immediately upon detecting any departure from acceptable criteria and inform the pilot, maintenance officer, or other designated person in charge as to the condition of the fuel delivered. Failure to identify and stop refueling operation can lead to loss of aircraft, pilot, and crew.

When off-specification fuel is identified, the refueling truck or other source of fuel will be placed out-of-service pending investigation and any corrective action that may result. The pilot, maintenance officer or other person in charge, when notified that doubtful or contaminated fuel has been delivered to an aircraft, will take action to determine whether the aircraft should be defueled and cleaned.

9.5.1 Appearance (Visual Test). The test shall be conducted using a round, transparent, glass bottle, 1 quart to 1 gallon in size. The bottle shall be clean. The sample is first visually inspected for color and presence of foreign matter. The sample shall then be swirled to form a vortex. Particles coarse enough to settle will collect as sediment on the bottom of the bottle directly beneath the vortex.

A passing sample shall be "clear and bright," which means free of any cloud, emulsion, or readily visible particulate matter. The color should be clear and colorless to straw-yellow. When any appreciable contamination is found, the test shall be repeated, paying particular attention to cleaning and rinsing the container prior to sampling. Also, if there is any question as to the quality of the fuel, both particulate and water measurements must be made using the CCFD and the FWD.

9.5.2 Particulates. Solid contaminants (rust and dirt) can be held well below a level of 1 mg/l in a properly functioning fuel distribution system. If solid contaminants in fuel at aircraft dispensing points exceed 1 mg/l, investigative and corrective action should be taken to improve fuel quality.

WARNING

If solid contaminants exceed 2 mg/l, delivery of fuel to aircraft shall be stopped and corrective measures completed prior to resumption of fueling operations. Loading aircraft with fuel with excessive contamination can result in a malfunction of the airframe or engine fuel system and subsequent loss of aircraft, pilot and crew.

9.5.3 Free Water. A satisfactorily performing filter/separator will provide fuel containing less than 5 ppm of free water. Should the level of free water in fuel at an aircraft dispensing point exceed 5 ppm, a second sample will be taken immediately to ascertain if the second sample confirms that the free water exceeds 5 ppm. If so, fueling shall be stopped until changes in procedure and equipment that reduce the free water to 5 ppm or below are effected.

CAUTION

During the receipt of fuel into a storage tank, if the other tests are satisfactory but the particulate and/or free-water contamination is high (above 2 mg/l of particulate contamination or 5 ppm of free water), extra testing and surveillance shall be conducted downstream to assure that this contamination is reduced by settling and filtration to acceptable levels before dispensing to aircraft.

9.5.4 FSII. FSII performs two important functions that help to avert significant safety-of-flight problems. First, it prevents the formation of water-ice in aircraft fuel systems, which can occur in certain susceptible aircraft. Second, FSII acts as a biostat preventing the growth of various microorganisms that can contaminate fuel systems (air station as well as aircraft), block filters, and promote corrosion.

The minimum level of FSII in fuel for USN/USMC aircraft requiring FSII to prevent water-ice formation is 0.03 percent. The minimum level of FSII in aviation

turbine fuel for other US services' and foreign aircraft is 0.07 percent.

Shore stations have no means of raising the FSII level of their JP-5 (or other turbine fuel). FSII materials are mutagenic and considered to be dangerous in the neat state; however, they are safe once blended into the fuel. Station injection of FSII is not recommended. Refer to MIL-HDBK-844(AS) for guidance on raising FSII level by commingling fuel between tanks.

If the FSII level falls below the 0.03 percent limit, the appropriate squadron CO or his/her designated representative shall be notified. Notification is required only for S-3, US-3, and SH-60 aircraft. Pilots shall consult the applicable NATOPS Aircraft Flight Manual for operating instructions, which will avoid resultant safety-of-flight problems.

Transient (USAF, USA, and visiting foreign military aircraft) crewmembers and pilots will be notified of low FSII (levels of 0.07 percent or less) in order that they may consult their appropriate technical directives for special operating instructions necessary to avoid water-ice induced problems.

WARNING

Failure to notify appropriate squadron personnel of low FSII condition can result in safety-of-flight problems.

Note

The B/2 Anti-Icing Test Kit Refractometer contains two FSII scales, one for each of the two different FSII materials currently in use. All JP-5 fuel tested shall be assumed to contain the high flash point type of FSII material, Diethylene Glycol Monomethyl Ether, or DiEGME, which is read off of the scale on the B/2 refractometer marked "JP-5" or "M."

9.5.5 Other Test Results. The results of all other tests shall be evaluated by comparison with the limits described in Appendix B, which contain the Deterioration Use Limits for Aviation Fuels. The limits in these two figures refer specifically to the acceptability of aircraft fuels for delivery to aircraft. The particular facility or ship from which the fuel is being removed and the one into which it is being loaded must be considered when applying these use limits; a limit on free water of 5 ppm maximum or 2 mg/l on particulates may not be applicable to a sample from a large shipment if subsequent cleanup in the fuel handling system can be anticipated.

Any activity that suspects either chemical contamination, deterioration during storage, or other unusual contamination or condition shall send fuel samples to an appropriate regional fuel laboratory (see Appendix B of MIL-HDBK-844(AS)) for testing. Samples must be clearly labeled as discussed in paragraph 9.3.3 with information about the suspected problem included in the remarks section.

WARNING

Failure to identify contaminated fuel and removal from use can result in reduced aircraft engine performance, malfunction, or catastrophic failure.

Inquiries pertaining to the quality or testing of aviation fuels and lubricants shall be addressed to COMNAVAIRSYSCOM (AIR-4.4.5), with a copy to NAVPETOFF.

9.5.6 Routine Correlation Samples. Compare test results obtained by the activity's in-house laboratory with those obtained by a regional fuel laboratory on the duplicate sample (see paragraphs 9.2.4 and 9.3.4.1). Some variation between the two test results is possible because of errors introduced by the shipment and storage of the duplicate fuel sample as well as differences in the test techniques. No action is necessary unless differences between the two results are greater than 0.8 mg/l. If this happens, recalibrate the CCFD following the instructions provided with the machine, review the testing procedure, and submit and test more duplicate correlation samples. If results are still unacceptable, contact NAVAIR AIR-4.4.5 for further guidance.

The results of the FSII correlation sample tests should also be compared. Variation by as much as 0.03 percentage points is considered acceptable. If greater differences are noted, review the procedure, recalibrate the instrument, and take additional correlation samples

and test them. If results are still out of the acceptable range, contact NAVAIR AIR-4.4.5. It may be necessary to procure a new refractometer.

9.6 GUIDELINES FOR REQUESTING REGIONAL LABORATORY SERVICES

1. Samples shall be forwarded to a Navy laboratory if practicable. See Appendix B of MIL-HDBK-844(AS) for a list of laboratories.

2. Decisions as to which laboratory to use shall be based upon laboratory proximity, capabilities, and workload if known.

Note

Not all laboratories are available for regular recurrent testing on a no-cost basis.

9.7 REGIONAL LABORATORY TEST METHODS AND REPORTING

The following paragraphs provide instructions to regional laboratories that receive fuel samples from a shore activity.

9.7.1 Routine Samples. Laboratories receiving samples for routine fuel quality checks shall test the samples as requested on the sample label for one of the following properties using the listed ASTM method:

1. Particulate matter (sediment), ASTM D 2276

2. FSII content, ASTM D 5006

3. Flash point, ASTM D 93.

Laboratories shall also note the presence of significant amounts of free water in the bottom of the sample container. Laboratories shall not run free-water determinations on routine samples since the free-water content of the fuel is severely affected by normal shipping and handling of the sample and results are meaningless.

Note

All JP-5 fuel tested shall be assumed to contain DiEGME.

9.7.2 Special Samples. Laboratories receiving special samples for testing shall conduct requested tests in accordance with methods authorized by the applicable fuel specification.

9.7.3 Reporting. Laboratories performing these tests shall report the results to the following:

1. Original — Commanding Officer of ship or station submitting sample.

2. One copy each — (All aviation fuel test reports)

   a. Commander
   Naval Air Systems Command (AIR-4.4.5)
   22229 Elmer Rd., Unit 4
   NAS Patuxent River
   Patuxent River, MD 20670

   b. Commander Naval Air Force
   U.S. Atlantic Fleet
   (Code N415 for ashore samples)
   Norfolk, VA 923511-5188

   or

   Commander Naval Air Force
   U.S. Pacific Fleet
   (Code 44 for ashore samples)
   Naval Air Station, North Island
   San Diego, CA 92135-5100

   c. Commanding Officer
   Navy Petroleum Office
   8725 John J. Kingman Road
   Suite 3719
   Fort Belvoir, VA 22060-6224

9.7.4 Report Forms. Regional laboratories are requested to report results in a form similar to Figure A-5 in Appendix A. It is essential that the CCFD and B/2 results reported by the sampling activity on the sample's label be included along with the results obtained by the regional laboratory.

9.7.5 Distribution Lists for Reports. It is the responsibility of the activity submitting samples to a laboratory to provide the laboratory with the desired distribution of reports in accordance with paragraph 9.7.4.

9.7.6 Message Reports. When a "special" fuel sample has been tested and the results exceed the deterioration use limits of Appendix B, the testing laboratory will report the finding as soon as possible by

telephone to the aviation activity that submitted the sample. The telephone report shall be followed by a message report. During nonworking hours, the aviation activity's duty officer shall be notified of the test results. It is unnecessary to report test results via telephone or message for "routine monthly correlation samples that exceed the use limits for particulates; however, if the FSII content is found below the 0.03 limit, a telephone and message report is required.

9.8 PROCEDURES FOR PREVENTING AND CONTROLLING CONTAMINATION

Contamination of aircraft fuel can be prevented only by the use of proper equipment and by carefully following proper operating procedures. Special "Retail," "Ready Issue," or "Service" fuel handling systems shall be used by all aircraft refueling activities to contain and process the fuel immediately prior to issue to aircraft. At shore stations these systems include an approximate 10-day supply (based on normal base issues to aircraft) storage capacity. Shore-based storage tanks used in this system must have sloping bottoms, bottom suction (pick-up), and continuous recirculation through a filter/separator that removes both water and particulates. Additional filter/separators further clean and dry the fuel as it is loaded onto trucks at truck fill stands or as it enters and/or exits direct refueling or hydrant systems. Special fuel quality filter/monitors (fuel monitor) that restrict or shut off the flow of fuel if exposed to excessive water or particulates are used in conjunction with filter/separators at truck fill stands, on trucks and hydrant hose carts, and at direct refueling stations.

The proper care, operation, and maintenance of these systems are essential in assuring that only clean, dry fuel enters aircraft. As a minimum, operators shall:

1. Observe and record the pressure drops at least daily across all filter/separators and filter/monitors in order to detect failures or problems.

Note

Pressure drop readings depend on the flow rate of the fuel through the filter. Meaningful readings can be obtained only if the system is operating at normal flow conditions during recirculation or flushing.

2. Take every precaution possible to prevent the introduction of any particulate matter (dirt) into the fuel. (See discussion in MIL-HDBK-844(AS).)

3. Install and maintain dust-tight caps or covers on all openings and connections, including refueling nozzles. These caps shall be removed only when item or system is in use.

CAUTION

Dust caps on Gammon fittings shall not be used on the flightline since they present a FOD hazard.

4. Brush away or remove any accumulated dirt or sand around fill covers, manholes, and other covered openings before removing cover.

5. Never leave a storage tank, refueler tank, or other vessel open to the air any longer than absolutely necessary.

6. Semipermanently secure refueler manhole covers.

Note

Recirculation of product and taking a sample through tank top openings is not authorized.

7. Do not operate any fuel handling equipment unless all filters, monitors, strainers, screens, and nozzle spout caps are properly installed and in place.

8. Never remove any filter, strainer, or screen for any purpose, except for cleaning or maintenance. Always replace filter or screen immediately after cleaning.

9. Observe and report any unusual operating condition, for example, if the refueling nozzle screen requires an unusual amount of cleaning.

10. Observe water that is drained from refueler and filter/separator sumps. It should appear clean. Report any unusual accumulation of foreign matter.

11. Drain (strip) and check all refuelers, tanks, filter/separators, and equipment provided with manual drains daily.

12. Circulate stagnant product in refueling equipment to remove condensate and particulate contaminants from lines, hoses and nozzles prior to aircraft issues. This is mandatory for any refueling equipment that has not been in use for a period of time exceeding 24 hours. Minimum circulation time must be determined locally for each piece of equipment depending on its configuration and size as well as fuel flow rate. Allow sufficient time for the fuel in the piping and hose(s) downstream of the fuel filter/monitor to be completely replaced by clean, dry fuel.

13. Ensure that regularly scheduled maintenance is properly performed.

14. Keep refueler tanks filled when not in use or when no defueling is anticipated.

15. Dedicate truck mounted or trailer mounted refuelers to one type of fuel: JP-5, JP-4, AVGAS, etc. Never use the same refueler with a different fuel until all equipment has been properly flushed.

16. Mark all refuelers in accordance with Naval Facilities Engineering Command Publication NAVFAC P-300, Management of Transportation Equipment. Ready issue (retail) storage facilities and distribution systems shall be marked in accord ance with MIL-STD-161F.

17. Check fuel product markings on each separate piece of equipment for agreement before initiating any fuel transfer operation.

18. Never load or carry two different aviation fuels in one refueler.

19. Use separate pipelines and equipment for each product.

20. Report and investigate any suspected contamination or irregularity detected. The FMO shall be responsible for initiating the investigation and formulating corrective actions.

21. Report and correct any leaking valves, lines, or connections.

22. Never use equipment configured solely as a defueler for refueling aircraft.

23. Cure hoses before using.

Note

API 1529/NFPA 407 hoses do not need to be cured.

CHAPTER 10

Safety in Shore Activity Fuel Handling Operations

10.1 INTRODUCTION

This chapter contains safety procedures and requirements that are either general in nature and therefore not covered by the other chapters of this manual or are extremely important and repeated here for emphasis. Any departure from the procedures of this chapter may adversely effect the overall safety of the operation being performed.

Although the procedures and requirements contained in this manual are as complete as possible, they are no substitute for a thorough knowledge of aviation fuels and their inherent characteristics and dangers. All aviation fuels personnel shall therefore be completely familiar with the information contained in MIL-HDBK-844(AS). As refueling personnel master a knowledge of aviation refueling, they will be better able to avoid and correct unsafe situations.

The development of safe and efficient fuel handling and aircraft refueling procedures is a continuously evolving process. Scientific investigations are coupled with actual field experience in order to establish the safest and simplest procedures possible. One of our most important sources of information in this process is the investigation of field accidents or problems. Therefore, it is extremely important that knowledgeable personnel be involved in accident investigations, especially whenever explosions or fires have occurred. Activities shall therefore request the assistance and participation of experts whenever major fuels accidents are being investigated to ensure that correct conclusions are drawn. NAVAIR, NAVPETOFF, and TYCOMs will assist in the identification of appropriate experts for any specific investigation.

10.2 ELIMINATING SOURCES OF IGNITION

10.2.1 Reducing Electrostatic Charges. One of the primary sources of ignition is static electricity. To ensure the safe relaxation of static charges relevant to fuel operations, all activities shall:

1. Prohibit the top loading or splash filling of any fuel vessel; e.g., trucks or tanks.

2. Refill filter/separator or monitor vessels slowly, whenever they have been drained.

3. Keep tanks free of foreign objects (i.e., small conductive objects that can be floated by foaming fuel, thereby becoming an unbonded charge collector). This does not prohibit suspending thermometers or samplers in tanks; however, these devices must be removed prior to any receipt.

4. Always electrically bond the refueling equipment to the aircraft or truck into which the fuel is being loaded.

5. Grounding is required for all hot refueling operations.

6. Check the electrical resistance of single point nozzle monthly. (See the nozzle manufacturer's technical manual for instructions.)

7. Bond overwing (gravity) refueling nozzles to the aircraft using a separate bonding pigtail before tanks caps are removed.

8. Attach bonding cables to aircraft using plug and jack method whenever available.

9. Inspect bonding and grounding cables, clamps, and plugs on a daily basis.

10. Check the electrical resistance of cables on a monthly basis.

11. Cease all fueling activities when lightning is observed within 5 miles of the facility.

12. Remove refuelers from aircraft parking areas during electrical storms.

13. Require fuel personnel to wear nonstatic producing and flame retardant clothing.

Note

Gortex outer garments are authorized for wear by refueling personnel.

10.2.2 Eliminating Other Sources of Ignition. To prevent or eliminate sources of ignition, activities shall:

1. Prohibit fuel personnel from wearing shoes with nails or other metal devices on the soles.

2. Advise fuel personnel not to carry or wear loose metal objects, such as knives or keys.

3. Check the exhaust piping on mobile refuelers daily to ensure that holes, cracks, or breaks do not exist.

4. Prohibit smoking, spark or flame producing items, open flames, or hotwork within 50 feet of any refueling operation.

5. Defer all repair work on fueling equipment during fuel handling operations.

6. Not introduce lights (except approved safety lights for use in hazardous locations) into any compartment or space where fuel or flammable vapors may be present. (API has determined that ordinary commercial two- and three-cell flashlights, using carbon zinc dry cell batteries, may be safely used around flammable fuel/air mixtures. Tests have proven them incapable of igniting vapors, even if accidentally dropped or the light bulb is crushed.)

WARNING

Always assume that fuel vapors (in a tank or above a pool of fuel) are in the flammable range; i.e., proper fuel-air mixture to ignite.

7. Not allow fuel personnel to carry "strike anywhere" matches or cigarette lighters.

8. Be certain that no repair or maintenance work is being conducted on the aircraft before starting the refueling or defueling operation.

9. Be certain that LOX operations are not being performed and LOX handling equipment is not located within 50 feet of fuel operation.

10. Be certain that aircraft radar and all unnecessary radio equipment is switched off before refueling or defueling commences. If it is necessary that equipment be warmed up prior to an immediate launch, be sure that it is not transmitting. The only exception to this rule occurs during hot refueling. Hot refueling operations require the pilot to keep in radio contact with the tower at all times.

11. Not conduct aircraft fuel handling operations within 300 feet of ground radar equipment.

12. Equip all internal combustion engines operated within 50 feet of fuel handling operations with spark-arresting type mufflers.

13. Avoid starting or stopping any engine, regardless of its configuration, within 50 feet of a fueling or defueling operation. This prohibition includes aircraft being serviced and adjacent aircraft, as well as ground support equipment. The starting or stopping of an engine within 50 feet of a fueling or defueling operation is sufficient cause for the operator to immediately shut down the fuel pump.

14. Open valves slowly to avoid or minimize any splashing in tanks.

15. Ensure pump suctions are flooded before starting in order to avoid introducing air into the fuel system. Air in the fuel system can produce fire/explosion in filter/separators (F/Ss) and cause pump damage. Truck and rail car off-load systems are especially prone to this problem.

16. Conduct overwing refueling only as a last resort and then only if operational necessity or aircraft design dictates.

17. Hold hot refueling operations to the absolute minimum possible. Cold refueling operations are inherently safer and are preferred to hot refueling.

10.3 REDUCING OR CONTROLLING VAPOR GENERATION

In order to help prevent fires by reducing or controlling vapor generation, activities shall:

1. Not handle aviation fuel in open containers.

2. Not refuel, defuel, or drain aircraft, or conduct fuel handling operations in a hangar or confined area, except for the removal of water and the extraction of samples from aircraft low point drains. This does not apply to structures specifically designed for these operations.

3. Keep all fuel containers, such as aircraft fuel tanks or vessels, closed except when necessary to open for actual operation.

4. Avoid spilling fuel during fuel handling operations.

5. Take immediate action to clean up any spill that occurs.

6. Properly dispose of oily waste or rags immediately after using.

7. Never drive or move a refueler or defueler with a leak in the tank, piping, or other equipment.

8. Report all leaks in any portion of the fuel handling facilities to the FMO.

9. Treat empty, or apparently empty, cans or containers that formerly held aircraft fuels as though they still contain fuel. These containers will still contain vapors and are dangerous for many days after they have been emptied.

10. Be aware that fuel vapors are heavier than air and will collect in low places, such as pits, sumps, and open sewers.

11. Never dispose of waste fuel in storm water or sanitary sewage systems.

12. Never top load or splash fill tanks. (This does not prohibit overwing refueling of aircraft that are solely configured for this operation.)

13. Keep all equipment and work areas neat, clean, orderly, and in good mechanical condition.

14. Never use gasoline or jet engine fuel as a cleaning agent.

10.4 EXTINGUISHING FIRES

Although the Air Station's Crash Crew (Crash, Fire, and Rescue) has prime responsibility for firefighting, all fuel handling personnel should be aware of the basic principles involved in extinguishing fires as well as the equipment used. For maximum effectiveness and safety, fire extinguishers must be operated in accordance with the specific procedures developed for each individual type. MIL-HDBK-844(AS) contains a special section on fire extinguishment that has been extracted from NAVAIR 00-80R-14, U.S. Navy Firefighting and Rescue NATOPS Manual. All refueling personnel shall receive flightline fire extinguishing training initially and annually thereafter.

WARNING

Use all fire extinguishers only for their intended purpose; i.e., to extinguish a fire. They shall never be used to inert a fuel tank since this can actually ignite a fire or explosion.

10.5 MINIMIZING HEALTH HAZARDS

Aviation fuels must be handled with caution because of the obvious dangers associated with possible fires and/or explosions, and because these materials, themselves, present a danger to the health of fuel handling personnel. These dangers are equally important as those of fires and explosions even though they are not so well known. MIL-HDBK-844(AS) contains a detailed discussion of the health hazards of aviation fuels.

In order to minimize health dangers, fuel handling personnel shall:

1. Avoid entering enclosed areas where fuel vapors are present.

2. Keep to an absolute minimum the amount of time spent breathing fuel vapors. Good ventilation of work spaces is essential.

3. Stay on the windward, or upwind, side of the spill when it is necessary to remain in an area where a large spill has occurred.

4. Stay on the windward, or upwind, side when conducting fuel handling operations where the formation of vapors is unavoidable, such as at a truck fill stand.

5. Stop the fuel handling operation and move to a fresh air location immediately if a feeling of dizziness or nausea occurs.

6. Avoid skin contact with liquid fuels and tank water bottoms that can contain a high concentration of FSII. If fuel or water bottoms do contact the skin, immediately wash with soap and water.

7. Never wash hands in gasoline or jet engine fuels.

8. Remove fuel-soaked clothing or shoes at once.

9. Wear eye protection and clothing that leaves a minimum amount of skin exposed during refueling operations. This will minimize burns in a fire.

10. Only use footwear that completely covers the feet in order to provide protection against fuel spills and fires. Shoes made of fabric or other absorbent materials are not acceptable.

10.6 CONFINED SPACES

Personnel entering or working in or around confined spaces exposed to fuels and fuel vapors may encounter potential hazards such as:

1. Lack of sufficient oxygen.

2. Presence of flammable or explosive vapors.

3. Presence of toxic vapors and materials.

These hazards may not always be readily apparent, detectable by odor, or visually obvious to persons entering or working within such spaces. Therefore, all confined or enclosed spaces such as fuel tanks, refueler/truck tanks, and unvented deep pits (over 5 feet) will be well-ventilated and tested prior to entry. Poorly vented or unvented pump rooms, storage areas, and unvented shallow pits (under 5 feet) must be surveyed to determine steps necessary for gas freeing or designation of a safe work environment. To minimize risk, fuel handling personnel shall:

1. Never enter a tank or vessel that has contained any fuel until all safety precautions have been followed and then only with experienced, knowledgeable supervision present.

2. Use a blower-type mask or positive pressure hose mask, boots, and gloves if it is necessary to enter a confined area where fuel vapors may be present.

3. Employ the buddy system when entering deep unvented or poorly vented pits; i.e., low point drain pits.

More definitive information regarding the hazards of confined spaces, hazardous environments, and gas-free engineering is contained in NAVSEA S6470-AA-SAF-010, U.S. Navy Gas-Free Engineering Program Technical Manual and the NAVOSH Program Manual 5100.23B. All personnel shall comply with the Navy policies and procedures specified in these manuals.

CHAPTER 11

Shore Activity Facilities and Equipment

11.1 GENERAL REQUIREMENTS

This chapter establishes the minimum requirements for aviation fuel handling equipment and facilities at all Navy and Marine Corps activities that fuel aircraft. Departure from the minimum equipment/facilities requirements established in this manual may adversely affect aircraft safety of flight as well as the safety of fuel handling operations.

11.1.1 Filtration Requirements. All activities that refuel aircraft must process the fuel issued to aircraft through a minimum of two fuel filtration systems between storage and entering the aircraft. Filtration equipment generates static electricity; therefore, all refueling systems must reduce static electrical charges to acceptable levels prior to loading on aircraft.

11.1.2 Maximum Refueling Pressure. All aircraft pressure refueling systems must limit the maximum pressure at the aircraft's adapter to 55 psi measured at the sample port of the refueling nozzle. During the last few seconds of a refueling operation the aircraft's internal tank shut-off valves close, creating an instantaneous pressure surge within the aircraft's fuel system. The pressure control device on every refueling system must react quickly enough to limit this surge pressure to below 120 psi. All modern aircraft are designed, built, and tested for refueling within these pressure limitations.

Note

Highly specialized equipment is needed to measure a system's maximum surge pressure. Such testing must be conducted in accordance with SAE AS 1284A.

11.1.3 General Design and Repair Requirements. All fuel handling facilities and equipment at Navy and Marine Corps shore activities shall be designed, constructed, and/or repaired in accordance with Naval Facilities Engineering Command (NAVFACENGCOM) criteria, which have been established in collaboration with NAVAIR and NAVPETOFF. These manuals are kept up-to-date and contain many new concepts for incorporation in future military construction. All repair and modernization projects for POL facilities at Navy and Marine Corps air activities shall conform to the requirements stated in these manuals. In addition, all facilities shall comply with local environmental, health, and safety laws. NAVFAC, NAVPETOFF, and TYCOMs can provide the FMO with help and guidance in developing repair and modernization projects.

Applicable publications are:

1. Facilities Planning Factor Criteria for Navy and Marine Corps Shore Installations, NAVFAC P-80, Category Code 121 entitled, "Aircraft Fueling/Dispensing Facilities."
2. MIL-HDBK-1022, Petroleum Fuel Facilities.
3. NAVFAC Definitive Design for Aircraft Direct Fueling Systems.
4. Unified Facilities Guide Specifications (UFGS).
5. Maintenance Manual Petroleum Fuel Facilities, NAVFAC MO-230.

11.1.4 Refueling Equipment Markings and Painting. All fuel servicing equipment shall be painted and marked in accordance with NAVFAC P-300. All refueling equipment shall be clearly marked with the appropriate NATO Code Number contained in a rectangle as well as the common U.S. military designation. For example, JP-5 refueling trucks shall carry the following symbol as well the JP-5 designation:

A complete list of the NATO Code Numbers can be found in Annex C of NATO STANAG 1135.

Refuelers used as revealers/defuelers shall be marked with only the product code JP since the fuel will, in most cases, be a mixture of JP-4, JP-5, JP-8, and/or commercial jet fuels. No NATO Code Number is to be applied to such equipment.

In addition to these product identification markings, all refueling equipment shall be marked with the following:

FLAMMABLE
NO SMOKING WITHIN 50 FEET

The emergency shut-off switch for each system shall be identified with 2-inch red letters.

Refuelers/defuelers/ground fuel vehicles shall be free of rusted areas, flaking paint, and running rust. When touch-up painting exceeds 20 percent of the unit surface, the entire unit shall be painted.

11.1.5 Illumination. Unless otherwise directed, all working areas shall be illuminated for night operations to the minimum intensity recommended in Table 3 of API Bulletin RP-540, Recommended Practice for Electrical Installations in Petroleum Processing Plants.

11.1.6 Electrical Equipment. Electrical equipment installed on or in close proximity to fuel handling or storage facilities shall meet the minimum requirements of NFPA 70 (based on explosive risk of JP-4), The National Electric Code; NFPA 77, Recommended Practice on Static Electricity; and NFPA 78, Lightning Protection Code.

11.2 REFUELING EQUIPMENT

The following paragraphs provide a general description along with the minimum requirements for equipment common to all refueling systems including mobile equipment. These requirements apply to both new and existing equipment. In addition, for new construction and modernization projects, NAVFAC DM-22 shall be consulted.

CAUTION

The design and construction of certain pieces of equipment listed in this chapter is especially critical to overall safety. For those items designated with an asterisk (*), activities shall use only those manufacturers' part numbers that have been tested and approved by COMNAVAIRSYSCOM.

11.2.1 Filter/Separators. The filter/separator is the primary device used at shore stations to keep aviation fuels clean and dry. Filter/separators shall be qualified to API-1581 or shall meet the performance requirements of MIL-F-8901 (using MIL-F-52308 DoD elements [NSN 4330-00-983-0998]). Filter/separators should be provided at the following locations:

1. In receiving lines upstream of all operational storage tanks; i.e., those tanks from which product can be pumped directly to aircraft.

2. In supply piping (downstream) from storage tanks to aircraft refueler truck fill stands.

3. On any discharge (downstream) side of transfer pumps that supply aircraft or revealers.

4. On any equipment that directly fuels aircraft; e.g., mobile refueling equipment, and portable fueling systems.

5. The main receiving points (upstream) of the bulk storage tanks. This will minimize receipt of water and sediment into bulk storage tanks and maximize time between tank cleaning. (The installation of a filter/separator is not practical at all receiving points; however, some device for the removal of particulates should be used depending on the method of delivery and flow rate involved.)

All metal downstream of a filter/separator, that is installed in a system designed to deliver fuel directly to an aircraft, along with that portion of the filter/separator that is in contact with the filtered fuel, shall be nonferric or stainless steel. Internally coated ferric materials are not acceptable downstream of the filter.

Each filter/separator vessel shall be outfitted with the following minimum accessories:

1. Manual water drain valve from the bottom of the water sump.

2. Automatic air eliminator valve.

3. Differential pressure gauge with 1-psi graduations to measure the pressure differential across the elements. The gauge shall be mounted, free of vibration, so that the reading indicator or needle will not fluctuate when fuel is being pumped under normal conditions.

4. Pressure relief valve.

5. Diaphragm-operated control valve on the main discharge line with a flow limiting pilot and a float operated pilot to close the main valve if the water level in the sump rises above the set point. This is also commonly referred to as a slug valve.

6. All manual water drains shall be connected to a portable or permanently installed recovery system. For environmental reasons it is recommended that pressure relief valves and air eliminator also be connected to a recovery system.

7. Head lifting device (for stationary installations only).

Vessels shall be designed and constructed in accordance with Section 8 of the ASME Boiler and Pressure Vessel Code that is current at the time of vessel construction.

11.2.2 Fuel Quality Monitors. Fuel quality monitors (formerly called go/no-go gauges) meeting the requirements of MIL-M-81380 shall be installed after filter/separators on truck fill stands and on all equipment that directly fuels aircraft. Monitors are not required for use with product receipt filters or those used exclusively for circulation of product. A pressure gauge shall also be installed on each monitor housing so that the differential pressure across the elements can be recorded. If the filter/separator vessel also incorporates fuel monitor elements, the gauge or gauges shall be installed in such a manner that pressure losses across the filter elements and the monitor elements can be recorded separately. Vessels shall be designed and constructed in accordance with Section 8 of the ASME Boiler and Pressure Vessel Code that is current at the time of vessel construction.

11.2.3 Relaxation Chambers. A chamber consisting of a tank or piping shall follow the fuel monitor or filter/separator (if no monitor is installed in the system), which will allow static electric charges that develop as the fuel passes through the filtration media to "relax" before the fuel enters a tank. Since fuel must be in contact with the metal walls of the relaxation device for at least 30 seconds, the exact size of the relaxation tank or length of piping shall be determined from the maximum flow rate of the system. Only one relaxation chamber is needed for each fuel monitor, filter/separator combination. Any tank, chamber, or other arrangement used to meet this requirement shall assure complete product turnover and shall have a water drain at its low point and manual or automatic air eliminator. Vessels shall be designed and constructed in accordance with Section 8 of the ASME Boiler and Pressure Vessel Code that is current at the time of vessel construction.

11.2.4 Fuel Meters. Temperature compensated meters should be installed (NAVSUP, Publication 1, Volume II, paragraph 23087.9) at point of custody transfer. Meters used for service such as fueling aircraft, motor vehicles or boats, or for loading tank trucks or tank cars, shall be positive displacement meters. Turbine meters may be used for larger volume steady-state transfers such as loading ships, barges, or pipeline transfers. For shore-based systems, all meters shall meet the accuracy requirements of the National Bureau of Standards Handbook 44, Liquid Measuring Devices, latest edition.

11.2.5 Fuel Pressure Gauges. Pressure gauges shall be easy to read and accurate to 1 psi with graduations in 1-psi units.

11.2.6 Sampling Connections*. Fuel sampling and pressure testing connections shall be installed at these locations: receiving points, tank outlets, inlet and outlet sides of filter/separators and fuel monitors, the refueling nozzle, and at each side of a block valve so that the fuel remaining in each portion of a fuel transfer pipeline can be sampled. All sampling connections shall be flush-type, dry-break, quick disconnects with dust caps (i.e., Gammon fittings).

11.2.7 Hoses. All hoses and couplings used for aviation fuel service at shore activities should meet the requirements of API 1529/NFPA 407. This is a semi-hardwall, noncollapsible hose. Diameter of the hose will be compatible with the desired delivery rate to aircraft. Unless otherwise specified, aircraft delivery hose on refueler trucks shall be a minimum of 50 feet in length.

Camlock hose couplings shall not be used downstream of the filter separators. Camlock hose fittings should not be used on mobile refueling equipment.

Shore-based hoses shall contain no electrical bond or bonding wire through the center of the hose, or in the carcass. Where two hose assemblies are attached to the same outlet or source of fuel, each shall incorporate its own shut-off valve in piping upstream of the hose.

11.2.8 Emergency Dry Breakaway Coupling*. An emergency dry breakaway coupling should be installed on the refueling hose at or near the place where the hose attaches to refueling equipment piping or hose reel. This device is required for each direct refueling system pantograph and recommended for all other installations.

11.2.8.1 Dry Break Quick Disconnect Coupling*. A dry-break, quick-disconnect coupling shall be installed at the nozzle end of the hose and shall be equipped with a 60- or 100-mesh screen, which is readily accessible without the use of tools.

11.2.9 Hose End Pressure Regulator*. Each single point refueling (SPR) nozzle assembly shall include a hose end pressure regulator set for a maximum of 55 psi.

11.2.10 Aircraft Refueling Nozzles*

1. Single Point Refueling (SPR) nozzles (also referred to as under–wing, type D–1, D–1R, D–2, or D–2R) — only those SPR nozzles qualified to the requirements of SAE AS5877 are approved for use. Nozzles shall be equipped with 60-mesh or finer strainers. A quick disconnect sampling connection shall be provided on the nozzle for taking fuel samples and for pressure checks.
2. Overwing nozzle (also referred to as “gravity” and “open port”) — nozzles shall meet the requirements of MIL-N-87963. Overwing nozzles shall have a strainer of 60 mesh or finer and a tube spout suitable to the type of fuel and aircraft being serviced. Each over-the-wing nozzle shall have permanently attached a flexible bonding wire of suitable length terminating with a plug type connector (a clamp type connector may be used if it conforms to MIL-C-83413).

If nozzles are to be interchanged on the same hose, each nozzle shall have attached its own half of the quick-disconnect coupling. Both pressure and overwing refueling nozzles shall have a satisfactory dust cover in place at all times when fuel is not being delivered.

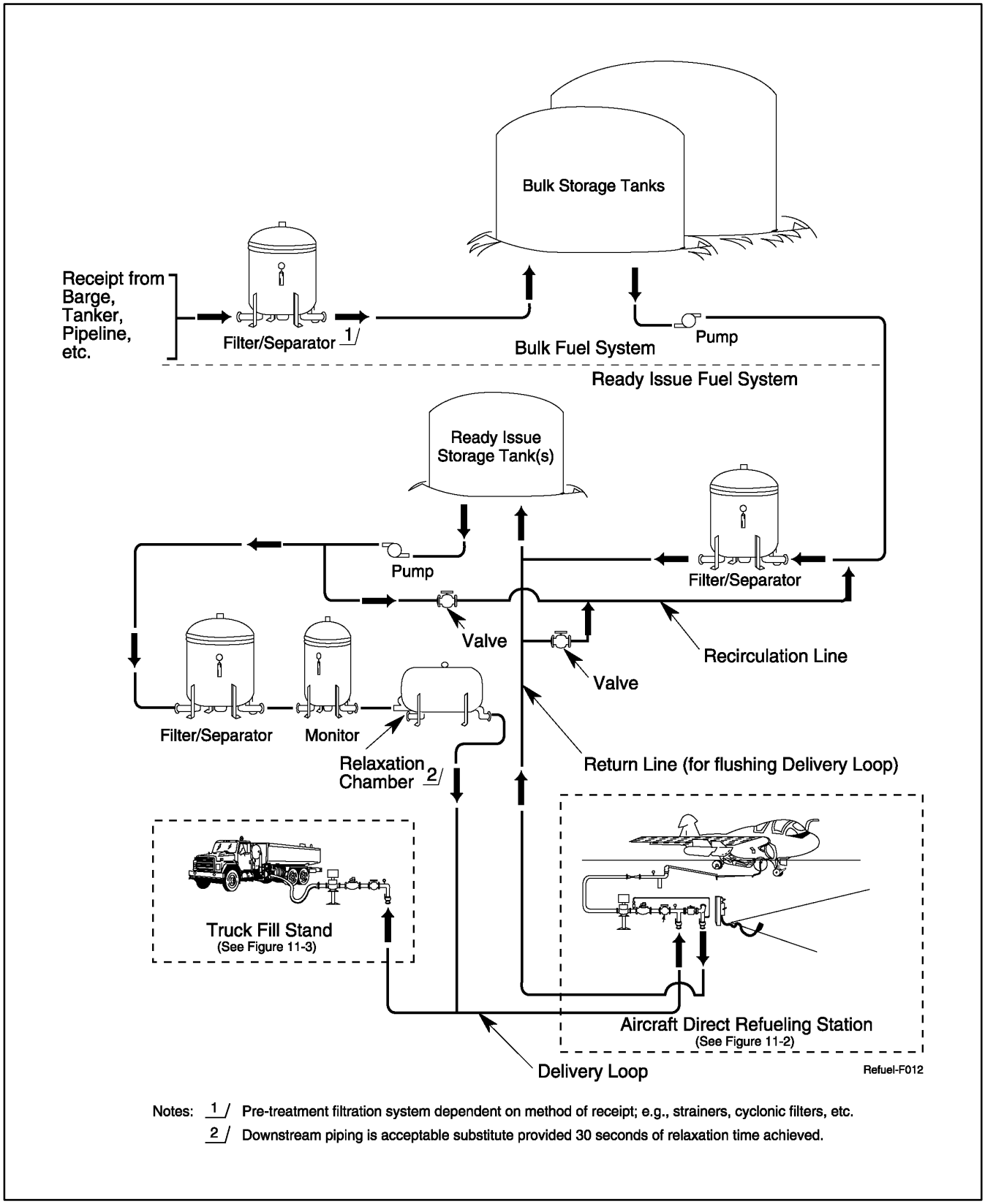
11.2.11 High-Level Shutoff. Each mobile refueler should be equipped with a high-level shutoff that provides a secondary fail-safe system and which causes the internal valve to close when product reaches the high level.

11.3 AIRCRAFT FUELING SYSTEMS

11.3.1 Aircraft Direct Fueling Systems. Aircraft direct fueling systems are designed primarily for “hot” refueling of aircraft. Aircraft direct fueling systems shall be installed only when authorized by NAVAIRSYSCOM. NAVAIR/NAVFAC are available for assistance in sizing and locating direct refueling systems. New aircraft direct fueling facilities shall be constructed only for the issuance of jet fuels through the pressure refueling method utilizing SPR aircraft servicing nozzles to dispense the product. Figures 11-1, 11-2, and 11-3 are simplified flow schematics of a shore activity’s fuel system which reflects the design requirements of MIL-HDBK-1022.

Criteria for the construction of direct fueling systems will be based primarily on the following requirements:

1. The volume of rapid turnaround requirements for carrier aircraft, including rotary wing.
2. The volume of large, land-based patrol aircraft requiring average refueling of over 2,500 gallons.
3. The number of transport aircraft, with limited ground time, which shall be refueled in place simultaneously with other loading and off-loading.



Notes: 1/ Pre-treatment filtration system dependent on method of receipt; e.g., strainers, cyclonic filters, etc.
2/ Downstream piping is acceptable substitute provided 30 seconds of relaxation time achieved.

Figure 11-1. Shore Activity Fuel System Flow Schematic

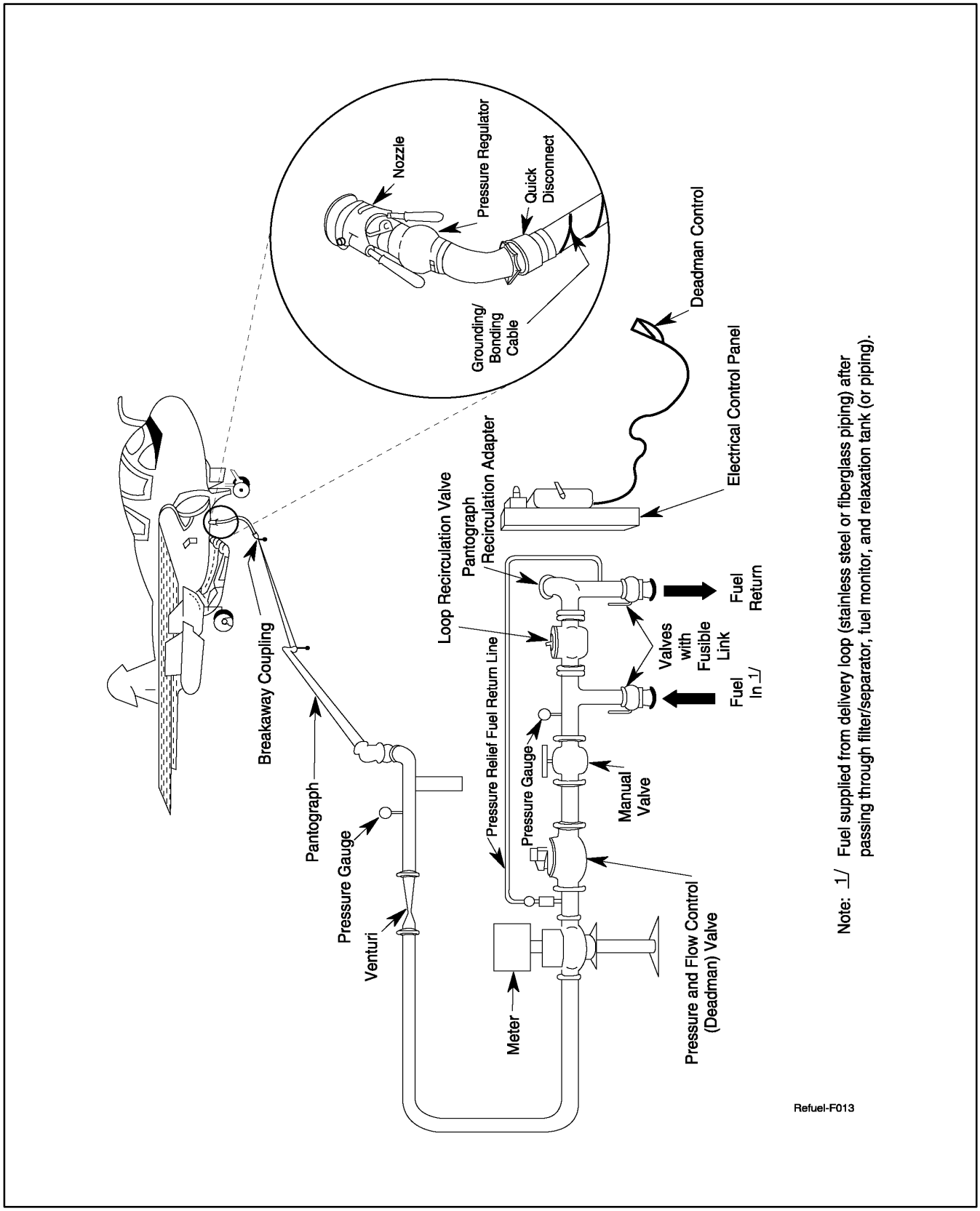


Figure 11-2. Aircraft Direct Refueling Station

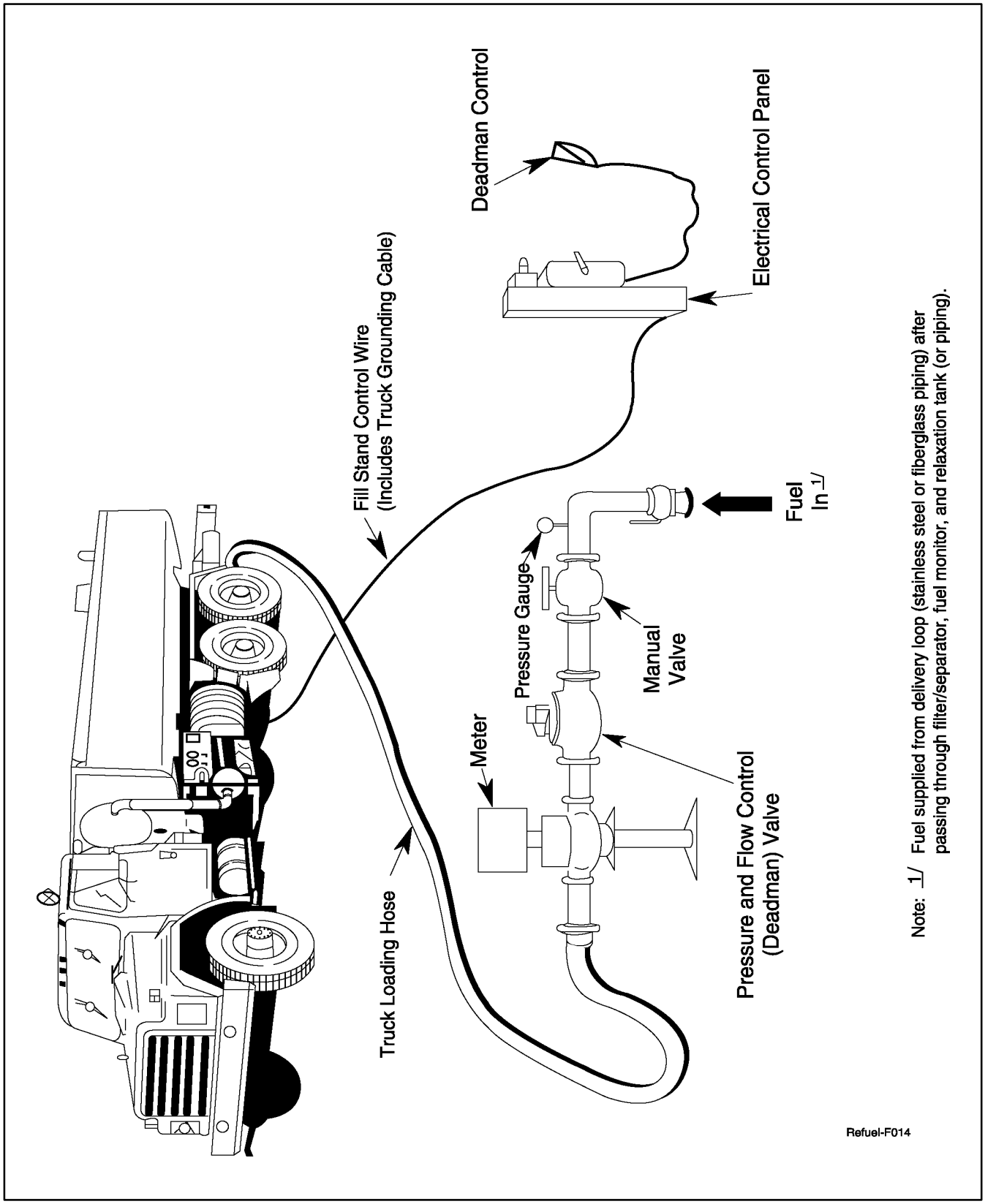


Figure 11-3. Truck Fill Stand

All direct refueling facilities shall have the following minimum features:

1. Filter/separator.
2. Fuel quality monitor.
3. Relaxation chamber or equivalent piping configuration capable of providing 30 seconds of static relaxation from point of last filtration to the nozzle.
4. Diaphragm-operated primary control valve.
5. Remote, hand-held, deadman control for each pantograph or hose installed at each station.
6. Emergency pump shut-off switch.
7. Meter on each station outlet.
8. Recirculation/flushing capability of the nozzle and or hose/pantograph system.
9. Emergency dry breakaway coupling on each hose or pantograph.
10. Bonding/grounding cable. This requirement is considered satisfied if the fueling hose/pantograph system has continuity (10,000 ohms or less).
11. Pantograph and/or hose with approved, non-lubricated swivels. Zerk-type grease fittings in pantograph swing joints are not authorized.

CAUTION

The use of swivel joints with zerk grease fittings is prohibited since they can contaminate the fuel with grease.

12. Dry-break, quick-disconnect fuel service coupling with 60- to 100-mesh strainer.
13. Single point pressure refueling nozzle with a 55-psi max pressure regulator.
14. Fire extinguisher(s) in accordance with NAVAIR 00-80R-14 (minimum of one, 150-pound HALON or TAU unit per fueling point).
15. Emergency eyewash/shower system available in the immediate area.
16. Fire alarm.

Note

Direct refueling systems shall not use or incorporate eductor systems.

11.3.2 Mobile Aircraft Refuelers. Mobile revealers are used primarily for cold refueling operations, with occasional hot refueling operations at stations where installation of a direct refueling system is not justified. If continuous or extensive hot refueling is being performed with mobile revealers, the use of an anchored pantograph shall be required (see Figure 11-4).

Note

An emergency dry breakaway coupling is required if mobile refueling equipment is being used for hot refueling operations.

Mobile aircraft revealers vary in capacities and configurations; however, whether contractor or Government owned, all shall have the same basic requirements. Contract revealers shall comply with NFPA 407 in addition to the minimum requirements listed below.

All military and contract revealers shall have the following minimum requirements:

1. Tank construction shall consist of one compartment only, with necessary baffles. Tank shall completely drain at low point without traps of liquid remaining in pockets. The tank shall be designed so that all portions are accessible for cleaning and maintenance.
2. Tanks shall be aluminum or stainless steel.
3. Tank top opening(s) shall be semipermanently secured and used only for inventory purposes and interior inspections and repairs. Manhole covers shall incorporate a fusible plug or plugs, each equipped with fine screens, to provide additional emergency vapor release.
4. Tank shall be configured for bottom loading. The bottom loading hardware shall include a cutoff valve, a MIL-A-25896 adapter to accept the standard SPR nozzle, and be of sufficient size to

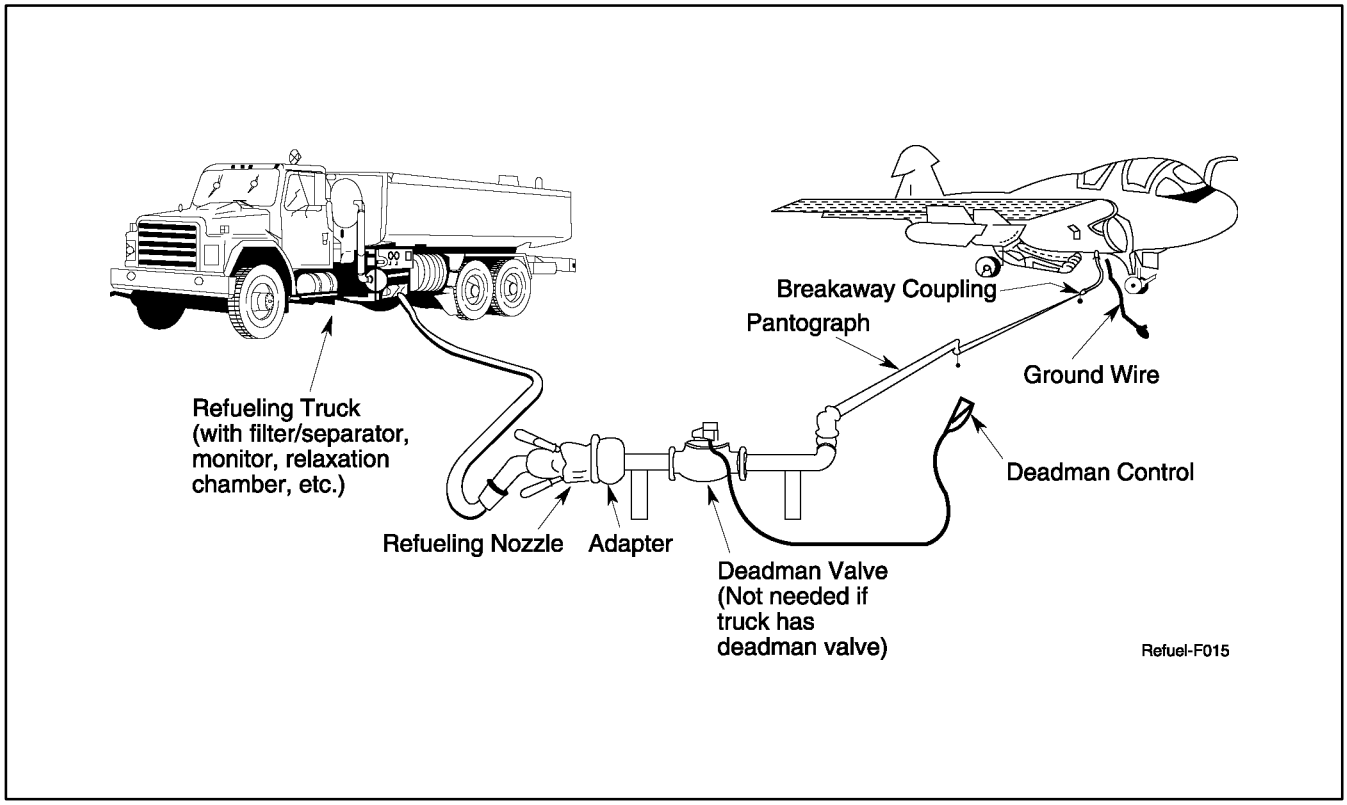


Figure 11-4. Hot Refueling with Truck and Pantograph

receive product at 600 gallons per minute. A fill stand anti-driveaway device shall be incorporated.

5. Each tank shall be equipped with an electronic system for controlling the filling operation (Scully Dynaprobe or equivalent), which is compatible with the system on the station's truck fill stand. It should be located near the bottom loading adapter and incorporate an anti-driveaway feature (can be combined with anti-driveaway device referenced above).

6. The piping system, including all hardware components, shall be capable of dispensing fuel at rated flow. A flow diagram illustrating the general configuration of these devices in the system is provided in Figures 11-5 and 11-6.

CAUTION

The use of swing joints with Zerk-grease fittings is prohibited since they can contaminate the fuel with grease.

7. Filter/separator
8. Fuel quality monitor
9. Relaxation chambers
10. Pressure and differential pressure gauges
11. Meter (temperature compensating meters are desired)
12. Approved aircraft refueling hoses
13. Dry-break, quick-disconnect coupling
14. Hose end pressure regulator
15. Approved aircraft refueling nozzles

Note

Refueler/defuelers shall have two separate hose/SPR nozzle assemblies — one that includes a hose end pressure regulator, for refueling service, and one without, for defueling operations.

16. Bonding cable with clamp that conforms to MIL-C-83413.

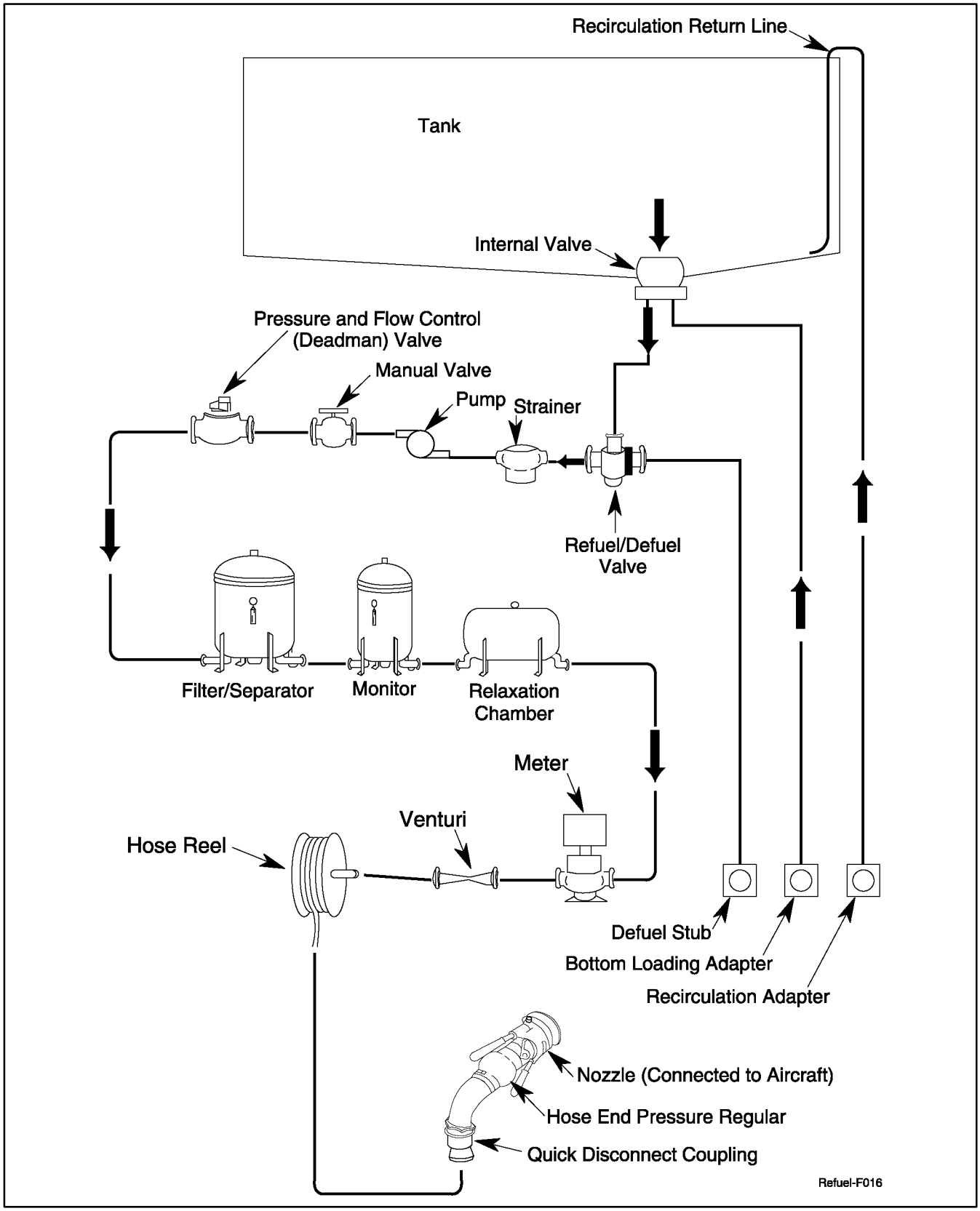


Figure 11-5. Flow Diagram for Mobile Refuelers

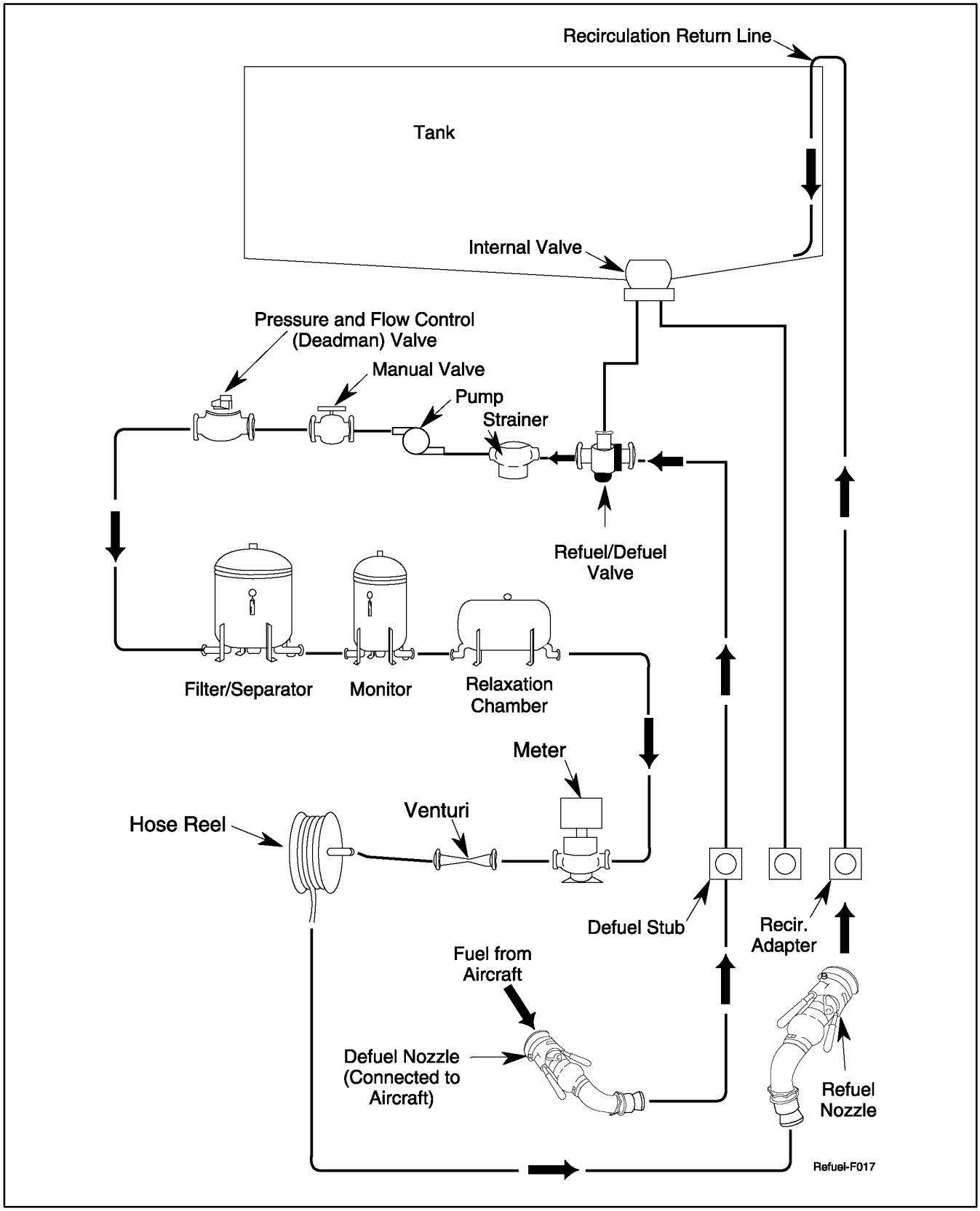


Figure 11-6. Flow Diagram for Refueler/Defueler in Defuel Mode

17. Aircraft fuel servicing vehicles shall have at least two fire extinguishers installed — one on the left (drivers) front side readily accessible from the operator (refueler control panel) position; the other extinguisher on the right rear portion of the vehicle. Each extinguisher shall have an ANSI rating of not less than 20-B.

Note

The use of Halon is recommended since it is superior to CO_2 and is less corrosive than PKP.

18. Remote, hand-held, deadman control

19. The exhaust of all engines (except turbo-diesel engines), including auxiliary engines, shall be equipped with a suitable spark arrestor. When replacing defective exhaust system components, use only the original manufacturer's parts.

11.3.3 Portable Fueling Systems. These air transportable, advanced base systems are used primarily to support tactical operations. They include the Tactical Airfield Fuel Dispensing System (TAFDS), Helicopter Expedient Refueling System (HERS), and Navy Advanced Base Functional Components Fueling Systems (ABFC-H14K). These systems are described in Chapter 17 of this manual. With the exception of the ABFC-H14K, these systems shall be operated and maintained in accordance with Chapters 18 and 19 of this manual. Since the ABFC-H14K possesses all of the required equipment, it shall be operated and maintained in accordance with Chapters 12 and 13.

11.4 AIRCRAFT DEFUELING EQUIPMENT

11.4.1 Refuelers/Defuelers. The most ideal and cost-effective method of handling nonsuspect defueled aviation turbine fuel is to reissue it to an aircraft. Most facilities that handle sizeable quantities of such fuel have designated one or more aircraft refueling trucks as "refueler/defuelers."

CAUTION

Manholes shall remain closed during defuel operations.

In addition to the requirements for revealers, refueler/defuelers shall meet the following minimum requirements:

1. Refuel/defuel trucks shall carry the marking "JET FUEL/JP" in place of the normal markings; e.g., "JP-5 JET FUEL F-44" or "JP-8 JET FUEL F-34."

2. A dedicated defuel connection to piping system that passes the fuel through the pump, filter/separator, monitor, and relaxation chamber before it enters the tank.

3. Separate hose and nozzle assemblies shall be provided on refuel/defuelers for each of the two different operations — refueling and defueling.

Note

Eductor-type systems or hose evacuation systems shall not be used for operations since they allow unfiltered fuel to be issued to the next aircraft.

4. Maximum defuel rate is 100 gpm.

5. High level alarm. (A high level cutoff system is highly recommended.)

11.4.2 Defuelers. These units are used for defueling only. Fuel placed in a defueler shall not be directly reissued into an aircraft since it is generally configured without filtration equipment and the fuel placed in a defueler unit is often suspect. Fuel in a defueler shall be sampled and tested to determine disposition.

Defuelers shall meet the following minimum requirements:

1. Trucks used exclusively for defuels shall carry the marking "DEFUELS ONLY" in place of normal markings.

2. A centrifugal pump with maximum defuel rate of 100 gpm

3. A cutoff or alarm system for overfill protection that has at least one of the following:

   a. Jet sensor

   b. Float high level

   c. Fiber optic or thermistor probe.

4. Defuel hose and nozzle shall meet the requirements of paragraphs 11.2.7 and 11.5.

Hose evacuation systems shall not be used for defueling.

11.5 AIRCRAFT REFUELER TRUCK FILL STANDS

The number of truck fill stands required for each product is a function of the filling time and the number and capacities of revealers necessary to sustain aircraft refueling services within the established turnaround times.

Note

Bottom loading fill stands are the only type authorized for use. Top loading is not authorized.

Overhead truck fill stands are no longer authorized for any petroleum product. The loading rack shall have a separate loading system for each grade of product to be handled. All truck fill stands, regardless of the type of fuel dispensed, are classified as Class 1, Group D Hazard areas as defined by NFPA and shall therefore comply with the regulations governing such areas.

Minimum equipment required at a truck fill stand for aviation fuel is:

1. SPR nozzle with dry break quick disconnect and strainer.
2. Loading hose, API 1529 type III, approximately 10 feet long or mechanical loading arm with non-lubricated swivels.
3. Loading hose fuel thermal pressure relief valve.
4. Diaphragm operated, two-stage control valve (low flow/high flow) with adjustable time delay to prevent the high flow pilot from opening until 1 minute after start of fuel flow.
5. Meter with rated capacity equal to the maximum flow rate of the loading station. Temperature-compensated positive displacement meters are recommended.
6. Filter separator*.
7. Fuel quality monitor*.
8. Relaxation tank or equivalent piping*.

Note

The above requirements marked with an asterisk (*) will automatically be met if the truck fill stand is a spur of the direct fueling system downstream of the filter, monitor, and relaxation chamber. All piping after the filter separator to the fill stand shall be non-ferrous or stainless steel.

9. Shutoff valves for maintenance.
10. Sample outlet.
11. A high level cutoff system. For ease of operation and increased safety, truck fill stands shall be configured with a high level cutoff system that incorporates the following: self-monitoring, automatic tank fill shut-off device; bonding; grounding; and remote, hand-held deadman control. Full implementation requires incorporation of companion connectors on all station revealers.
12. Low intensity instrument lighting to permit full visibility of all equipment and controls during night operations.
13. Spill containment system that will prevent the run-off of fuel in the event of tank rupture or major spill during loading operations. Concrete shall be used instead of asphalt because spilled fuel or fuel leaks deteriorate asphalt surfaces.

Note

Recommend that slopes over containment curbs be no more than 2 percent.

14. Overhead lighting in the immediate truck fueling area.

11.6 TRUCK PARKING AREAS

11.6.1 Condition of Truck Parking Areas. Each activity shall have adequate truck parking areas accessible by good roads. Both the parking area(s) and the access roads shall be paved and maintained in good condition. Parking areas shall be free from chuck holes and ruts, which cause refueler damage and FOD. In addition, refueler parking areas shall be contained by appropriate curbing, dikes, retention ponds, or drainage to oil/water separators (the preferred method). The method used shall be sized to contain the largest vessel normally parked within the area. The use of concrete is preferred over asphalt because spilled fuel or fuel leaks deteriorate asphalt surfaces.

11.6.2 Parking Area Requirements. Refuelers/fuel servicing equipment shall be parked in designated parking areas. Equipment shall be positioned so that it is free to exit its designated parking areas without backing up or abnormal maneuvering to avoid structures such as buildings, pipelines, fill stands, and other equipment. Activities shall have sufficient truck parking spaces to allow:

1. A minimum lateral separation of 25 feet (measured center to center of truck) between trucks.

2. No trucks to be parked closer than 100 feet to any inhabited building.

3. Separate entry/exit gates designed to facilitate one-way traffic patterns within the parking area.

4. Free and direct egress from the parking area of any truck at all times. No object or another truck may block or hinder the egress of any of the trucks parked in an area. This means absolutely NO backing, NO jack-knifing, NO additional maneuvering.

5. Security fencing to preclude unauthorized unintended entry into the refueler parking area if the fuel compound is not already fenced. Vehicle personnel gates shall be secured. Remote control gates with driver operated control devices are recommended.

6. Security lighting capable of illuminating the entire refueler parking area.

7. Spill containment system that will prevent the run-off of fuel in the event of tank rupture or major spill. Concrete shall be used because spilled fuel or fuel leaks deteriorate asphalt surfaces.

Note

Recommend that slopes over containment curbs be no more than 2 percent.

11.7 RECEIVING STATIONS

Fuel can be received by pipeline, barge, railroad tank car, tank truck, or any combination thereof. Receiving stations are tailored to the method, quantities, and rates of fuel delivery. Aviation fuel should be received through a filter/separator or other appropriate filtration device. This is an essential requirement when fuel is received directly into an air station's or facility's operational storage tanks. Weight handling equipment may be necessary in conjunction with barge receipts in order to facilitate large diameter hose handling. Communications equipment may be necessary for barge or pipeline receipt to coordinate an uninterrupted product flow. Appropriate environmental protection equipment, facilities, and procedures shall be provided in order to comply with Federal, State, and local environmental laws.

11.8 STORAGE TANKS

Tanks located at air activities provide the operating supplies of aviation fuel for aircraft. Storage tanks can be classified as bulk storage or operational storage.

All tanks shall comply with the following requirements:

1. All operational or ready issue steel tanks shall be 100 percent coated with an inert material such as polyurethane or epoxy. All bulk steel fuel storage tanks shall be coated on the bottoms and up 1 meter (38.6 inches) on the sidewalls. All concrete tanks storing aviation fuel shall be 100 percent lined on the floor and sidewalls to make them impervious to fuel.

2. All aviation turbine fuel operational storage tanks shall be equipped so that the fuel can be circulated through a filter/separator and returned to the tank, thus removing any bottom sediment and water. Outlets must be at lowest point of tank to eliminate water bottoms. All aviation fuel tanks shall also be equipped with a water stripping system.

3. Tank roofs shall be in good repair and not allow rain water to enter.

4. Tank repair projects shall conform to MIL-HDBK-1022.

5. Fill connections for all types of tanks shall be sized so that the velocity of the fuel during filling shall not exceed 3 feet per second. Inlets shall discharge fuel horizontally near the bottom of the tank.

6. All bulk storage tanks shall be equipped with adequate sumps, drain lines, and water drawoff lines such that tank water bottoms can be kept at

an absolute minimum. Recovery tanks that remove water and recover fuel are recommended for environmental reasons.

7. All tanks shall be fitted with automatic gaging devices and high and low level controls in order to prevent the overfilling of tanks and the exposure of pumps to cavitation.

   a. Gauging Devices. The automatic gauge shall be a float or similar device with a readout that is readily accessible and visible at eye level from the ground immediately adjacent to the tank. The readout shall be of a type that is compatible with a remote reading system.

Note

Float-type gauging devices shall not be used for custody transfer/inventory purposes.

   b. High Level Alarms and Automatic Shutoff. Two high level alarms and automatic shutoffs shall be provided.

      (1) High Level Alarm (HLA) shall be set at approximately 95 percent of the safe tank filling height arranged to actuate an audible alarm signal located at or near the normal station of the person in control of the tank filling operation. Remote alarms shall be located where they can be monitored at all times.

      (2) A high level shut-off valve that is mechanically actuated to stop the flow into the tank is located between the HLA and the high-high level alarm (HHLA).

      (3) HHLA shall be set at approximately 98 percent of safe filling height. It shall continue the audible alarm and in addition, actuate a visible alarm.

   c. Low Level Alarms. The low level alarm shall actuate an audible alarm that is distinctly different from the high level alarms and stop product transfer pumps.

WARNING

Alarms shall be left in active mode at all times.

8. All above ground tanks shall be surrounded by an enclosure that is capable of holding the entire above ground capacity of the tank plus one foot freeboard, in the event the tank should rupture or leak. This is usually accomplished with impermeable dikes.

9. Except when physically draining dikes, dike drains shall remain closed and locked.

10. Other environmental facilities/equipment as necessary to comply with Federal, State, and local laws.

11.9 TRANSFER LINES

Fuel passes through transfer pipelines of varying diameters and construction materials in its route from tank-to-tank, storage-to-truck fill stands, and storage-to-hydrant systems. Transfer lines shall not leak or introduce excessive contaminants to the fuel. To reduce iron contamination in fuel, use of internally coated pipe or other noncorrosive materials in these lines should be considered.

11.10 FUEL DIVISION SPACES

11.10.1 Fuel Office. An office with sufficient space to perform the necessary planning, administrative, and management functions associated with the accomplishment of the Fuel Division's mission is essential. The office can be shared by the FMO, assistant FMO, and administrative staff. In the latter instance, to prevent the appearance of a conflict of interest, a partitioning that affords a degree of privacy to both the Government and contractor personnel is required. At smaller activities that do not require a formal dispatcher's desk, the fuels office can be the work center for aircraft refueling operations; however, in such instances it shall be connected to the fuels crew ready room by an intercommunications system.

11.10.2 Fuel Crew Ready/Training Room. The fuels crew ready/training room should include the following minimum equipment:

1. Dispatch desk
2. Climate control suitable for facility location
3. Classroom with:
   a. Chairs
   b. Blackboard

c. Display board

d. File cabinet

e. Book shelves or cabinets for publications

4. Lockers and dressing room

5. Toilet and shower facilities

6. Phone and other communications equipment.

11.10.3 Fuel Workshop. The workshop should contain a good sized and convenient workbench with compressed air and electrical outlets available. Adequate storage space for frequently used tools, spare hardware items, and accessories shall be provided adjacent to the workbench.

11.10.4 Fuel Division Storeroom. An adequate storeroom for spare hoses, nozzles, filter and monitor elements, special tools, special clothing, test equipment, and fuel spill clean-up equipment is required. Size and location are determined by each facility but the key is to provide sufficient space for orderly storage and location for ready access to needed material by fuels division personnel.

11.10.5 Fuel Division Laboratory. The fuel laboratory size and associated equipment depend upon the scope of the quality surveillance and testing program performed. The laboratory shall be in accordance with applicable NFPA and CFR codes. The absolute minimum laboratory requirements for an activity that refuels aircraft are:

1. Lighting and fixtures in accordance with NFPA 70 (explosion risk shall be assessed on the basis of handling JP-4 and/or AVGAS, in addition to JP-5).

2. Climate control; e.g., air-conditioning/heating.

3. Sink with running hot and cold water.

4. Workbench(s) or counter(s) of sufficient size to accommodate and maintain all required test equipment in a ready-to-use position. The countertops shall be composed of a nonpermeable material suitable for working with petroleum fuels. Laboratory flooring material shall also be impermeable and suitable for a fuels laboratory.

5. Storage cabinets for test equipment support items; for example, bottles, drying rack, spare millipore pads.

6. Hydrometers.

7. CFD. Several versions of this device, referred to by different names, are currently in use. The CFD, the AEL Mark III, or the combined contaminated fuel detector (CCFD) are all acceptable.

8. FWD.

9. B/2 Anti-Icing Test Kit.

10. Pensky-Martin Flash Point Tester.

11. Fume hood.

Note

Each activity should possess at least two CCFDs and two FWDs in operating condition. Aircraft refueling operations shall not be performed if fuel contamination levels cannot be routinely tested as required by Chapter 9 of this manual.

12. Emergency eyewash/shower.

13. Outward opening doors with panic bars.

14. Portable firefighting equipment.

15. Telephone.

16. Fire alarm box.

11.11 MISCELLANEOUS FUEL DIVISION SAFETY EQUIPMENT

Fuel tank farm areas and transfer points shall contain adequate firefighting, fire alarm, and emergency eyewash/shower equipment as specified by applicable NFPA or CFR codes.

CHAPTER 12

Operating Procedures for Shore Activities

12.1 INTRODUCTION

This chapter establishes minimum operating procedures to assure safe handling of aviation fuel. The operating procedures presented and discussed in this chapter are for general types of fuel facilities and equipment common to all or most activities engaged in the fueling of aircraft. They include the basic steps that, for safety reasons, must be performed with each fuel handling operation with particular emphasis on the fueling of aircraft. Any departure from the procedures of this chapter may adversely affect the overall safety of the operation being performed.

WARNING

Refueling personnel shall discontinue any fuel operation that does not appear to be progressing in a normal fashion (e.g., appears to be taking much longer than would normally be expected, or pressures are too high, etc.) or when a safety violation is in evidence, and shall immediately notify the FO or FMO. Failure to recognize and terminate such an operation can lead to a catastrophic accident.

The operating procedures presented and discussed in this section are for general types of fuel facilities and equipment common to all or most activities engaged in the fueling of aircraft. Since the actual facilities and equipment vary greatly from installation to installation, these procedures and accompanying information are designed to serve as a basic outline and guide to the FMO in the preparation of detailed, written, operating instructions for the utilization of the equipment and facilities under his jurisdiction. This is one of the FMO's most important and technically demanding responsibilities. No deviation shall be made from the procedures contained in this chapter without the full cognizance of the FMO. In those situations where abnormal fuel operations are required, the FMO will determine whether or not to proceed with the proposed action. Assistance is available to the FMO in accomplishing this task from NAVFAC, NAVAIR (Code AIR-4.4.5), NAVPETOFF, and/or TYCOMs.

Note

NAVAIR 00-80T-103, Conventional Weapons Handling Procedures Manual (Ashore), prohibits the simultaneous fueling and loading/downloading of weapons.

12.2 GENERAL OPERATING PROCEDURES

Fuel delivery equipment shall be operated by qualified fuel personnel and shall not be subcustodied to other than fuel management organizations. The following procedures are general in nature and shall be applied to all operations performed by each unit/activity engaged in the fueling of aircraft.

12.2.1 Spill Prevention and Control. Proper training of fuel servicing personnel is essential. Proper maintenance of the equipment is equally essential. Leaking or malfunctioning equipment shall be removed from service. Self-closing nozzles or deadman controls shall not be blocked open or bypassed. Kinks and short loops in fuel hoses shall be avoided. In addition, a fuel spill/fire prevention drill must be conducted at least quarterly in accordance with NAVSUP P-558.

When a spill is observed, the fuel servicing shall be stopped immediately by release of the deadman control, by closing the nozzle handle, or by operation of the emergency fuel shutoff. The supervisor shall be notified at once and the operation shall not be resumed until authorized by the supervisor. Every fuel spill shall be investigated to determine the cause, whether emergency procedures were properly carried out, and what corrective measures are required.

12.2.1.1 Priming Spills. Pint-size spills, involving an area less than 18 inches in any dimension, require no emergency action during cold refueling operations; however, ramp personnel shall stand by with a fire extinguisher until operations are complete and/or the

aircraft departs. A spill or leak of any size is cause for terminating a hot refueling operation.

12.2.1.2 Small Spills. Other small spills involving an area of from 18 inches to 10 feet in any dimension shall have a fire guard posted, equipped with at least one fire extinguisher. Either absorbent cleaning agents (such as diatomaceous earth) or emulsion compound may be used to absorb the spilled fuel. Contaminated absorbent shall be placed in metal containers with closed lids until they can be removed and disposed of in accordance with local hazardous waste disposal procedures. An exception to this method may be authorized if the spill occurs in an area where no operations are in progress or will be conducted until ample opportunity is provided for volatile fuels to evaporate harmlessly. In such an event, the area shall be roped off. Fuels such as JP-5, which will not evaporate readily, shall be removed by one of the methods indicated above.

WARNING

Fuel contact can adversely affect some types of ramp surfaces.

12.2.1.3 Large Spills. Large spills covering an area greater than 10 feet in any dimension or over 50 square feet in area, require handling by the Spill Response Team. The team shall be summoned immediately and all other personnel evacuated to a safe distance. No one shall be permitted to walk through the liquid area of a fuel spill.

Note

The above spill size designations are general. Local regulations may be more stringent.

12.2.1.4 Navy Oil Discharge Response. All fuel spills shall be reported immediately to the Activity's Environmental Coordinator in accordance with the local oil spill contingency plan.

Note

All fuel handling personnel shall be familiar with the local oil spill contingency plan.

Note

All FMOs shall be thoroughly familiar with OPNAVINST 5090.1.

12.2.2 Surge Pressure Control. All fuel handling procedures shall be designed to minimize surge pressure. The following actions will help to accomplish this:

1. Close all valves slowly, particularly during the last half of the closure.

WARNING

Even during an emergency such as a hose or pipeline leak, valves shall be closed slowly. Rapid closing of a valve can create a surge pressure of sufficient magnitude to rupture pipes or systems.

2. Pressure gauges shall be installed in critical places on the flow-inlet side of controlling valves so the operator can keep pressures within limits as the valve is closed.

3. Start and stop booster pumps with bypasses opened, if there is such a provision; then slowly close them.

4. In multiple pump operations, start and stop pumps one at a time.

5. In starting an operation, open the downstream valve first and work toward the pumping source.

6. In stopping an operation, reverse the above and close the upstream valve first.

7. Fill all empty or partially empty lines slowly, particularly a line system involving steep slopes.

8. Where practical, keep both receipt and issue pipelines packed.

12.2.3 Night Vision Goggles. Use of night vision goggles during refueling operations shall be in accordance with local procedures.

12.3 REFUELING AIRCRAFT AT DIRECT FUELING STATIONS WITH ENGINES OFF (COLD REFUELING)

Each activity shall record its direct refueling operations with a log similar to Figure 12-1.

12.3.1 Pressure Refueling

12.3.1.1 Personnel Requirements. Refueling aircraft in static condition at fueling hydrants, direct refueling stations, skid mounts, and other fuel service units requires a minimum of two people trained and certified in accordance with Chapter 8 — a nozzle operator and a fuel system operator who will also perform the duty of a fire extinguisher operator.

12.3.1.2 Procedures. Aircraft refueling tasks are to be performed in the following sequence and verified by the pit station operator:

1. Recirculate (flush) the station and take fuel sample for quality control checks as appropriate. (station operator)

WARNING

Fuel shall be recirculated/flushed through refueling hose and nozzle, and tested for contamination prior to refueling the first aircraft each day. Fueling shall not begin until acceptable results have been obtained; e.g., clear and bright with no visible sediment (see Chapter 9). Failure to provide clean, dry fuel to the aircraft can adversely affect safety of flight.

2. Check for hot brake condition. (plane captain)

Note

Hot brake check is applicable to fixed-wing aircraft only.

3. Tow aircraft into the direct refueling station, chock it, and secure the engine. (plane captain)

CAUTION

Aircraft shall be parked in the refueling area so that the DFS hose does not need to pass underneath the aircraft to reach the SPR receptacle.

Note

- Aircraft shall not be cold refueled simultaneously while conducting hot refueling at the same direct refueling station.
- If an aircraft is towed in the refueling area and the tractor remains attached, its engine shall be secured until completion of the refueling evolution.

4. Secure all electronic and electrical switches on the aircraft not required for fueling. (plane captain)
5. Verify that the fire extinguisher is at the refueling point. (station operator)
6. Prior to cold refueling aircraft carrying ordnance, qualified squadron personnel shall verify that all ordnance is safed. Safed is defined as the replacement of any mechanical arming level, safety pin, electrical interrupt plug/pin, securing of armament switches, and/or any appropriate action that renders the particular ordnance carried as safe.

WARNING

- Refueling of aircraft with hung ordnance of any type is prohibited.
- Explosive loaded combat aircraft are not permitted in the fuel pits.

Note

- In direct fuel systems, bonding is usually accomplished through the nozzle/hose/pantograph system (see Figure 12-3).
- If bonding is not accomplished via the nozzle/hose/pantograph system, the bonding connection shall be made using the grounding receptacle near the aircraft's refueling adapter. If this is not possible, connection shall be to bare metal on the aircraft.

DIRECT REFUELING STATION LOG						
Refueling Station (Pit) #:				**Date:**		
Time	**A/C**			**Quantity Issued (Gallons)**	**SQDN Signature**	**Station Operator's Initials**
	Type	**BUNO #**	**SQDN**			

Figure 12-1. Direct Refueling Station Log

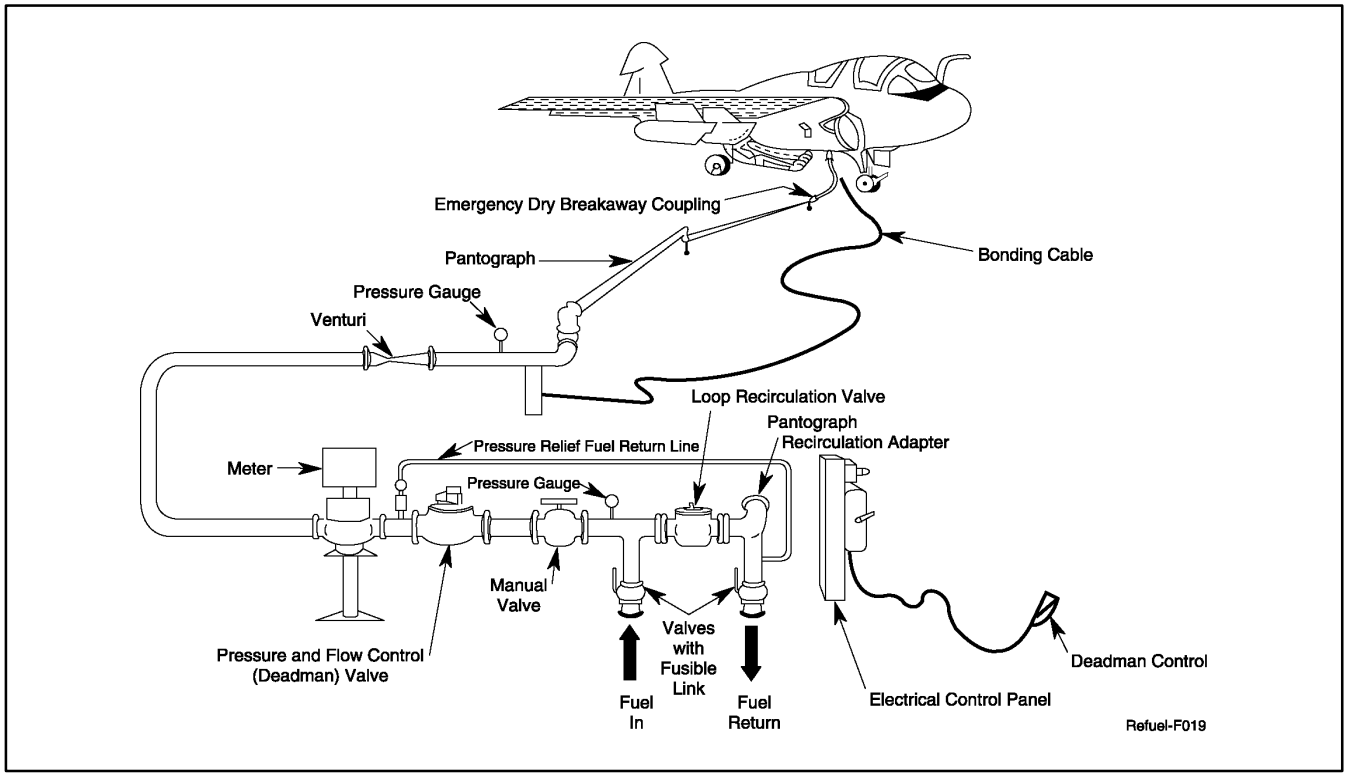


Figure 12-2. Bonding of Aircraft to Direct Refueling Station

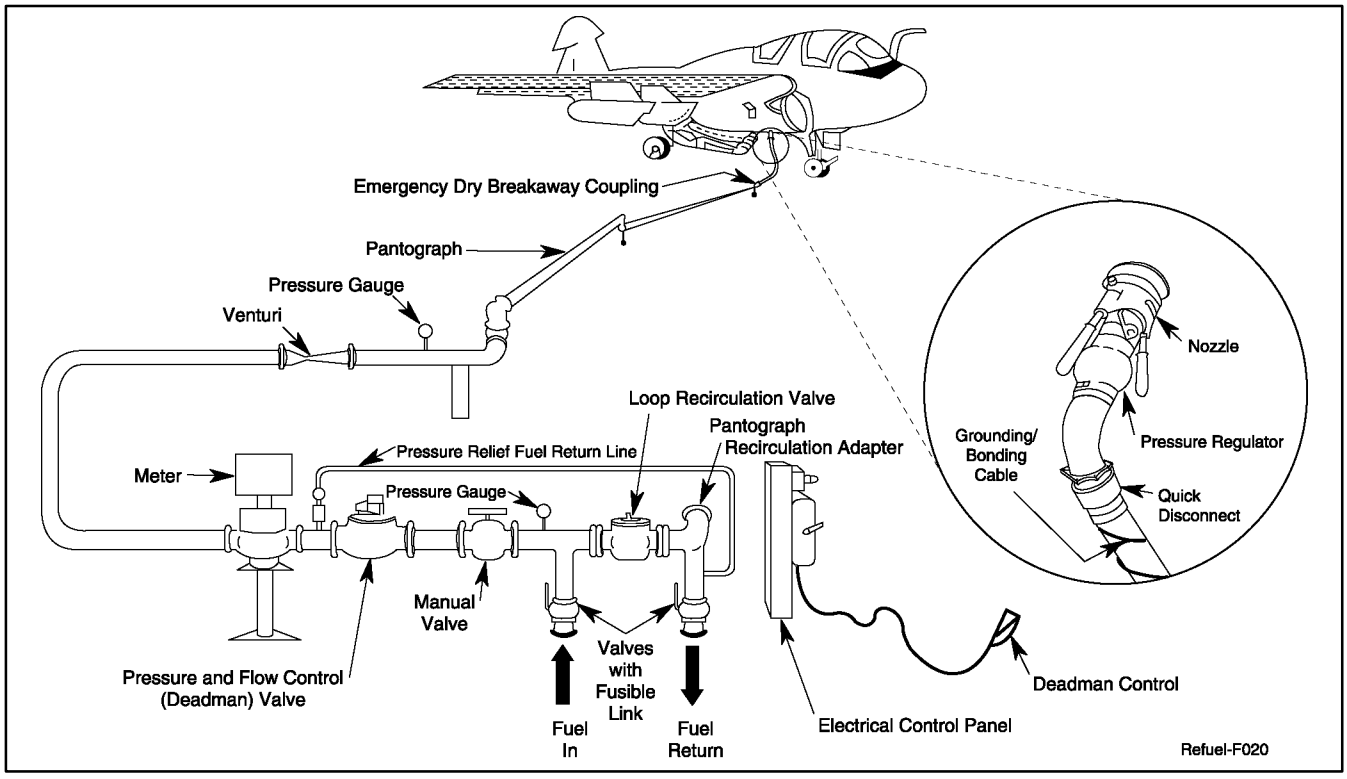


Figure 12-3. Bonding and Grounding Via Nozzle Connection

7. Attach bonding cable between the refueling equipment and the aircraft (see Figure 12-2). (plane captain)

8. Pull out the pantograph (or reel out hose) and place in proper position for refueling. (nozzle operator and station operator)

9. Remove refueling adapter cap from the aircraft and the dust cover from the SPR nozzle. Inspect the face of the nozzle to ensure it is clean and verify that the flow control handle is in the fully closed and locked position. (nozzle operator)

10. Visually inspect the aircraft's adapter (receptacle) for any damage or significant wear. If any doubt about the integrity of the adapter exists, use the adapter go/no-go gauge (NSN 1RW-5220-01-301-9247) or alternate go/no-go gauge (NSN 5220-01-343-1688) to determine acceptability. (nozzle operator)

WARNING

A worn or broken adapter can defeat the safety interlocks of the refueling nozzle permitting the poppet valve to open and fuel to spray or spill.

11. Lift nozzle by lifting handles, align the lugs with the slots on the aircraft adapter, and hook up to the aircraft by pressing it firmly onto the adapter and rotating clockwise to a positive stop. (nozzle operator)

WARNING

Nozzle must seat firmly on the adapter and not be cocked. Cocking can indicate a malfunction of the nozzle's safety interlock system that can lead to a fuel spray or spill.

12. Zero the refueling station's meter or note the station's totalizer reading. (station operator)

13. Upon receiving signals from nozzle operator/plane captain that hook-up has been completed and fueling operation is ready to begin, station operator actuates the remote, hand-held, deadman control.

WARNING

- Deadman controls shall not be blocked open or otherwise compromised. This defeats the purpose of the device and can lead to a catastrophic accident.

- Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until evolution has been completed or refueling has been stopped for an emergency. (For example, NO aircraft engines or auxiliary power units shall be started or stopped and external power shall NOT be connected, disconnected, or switched on or off.) Changing the aircraft's electrical power status can create significant ignition sources.

14. When hose is fully charged, rotate the nozzle flow control handle to the FULL OPEN position. The handle shall rotate 180 degrees to ensure that the poppet valve is fully open and locked. (nozzle operator)

WARNING

The flow control handle of the single point pressure refueling nozzle shall be placed in either of two locked positions — fully open or fully closed. The handle is NOT to be used as a flag to indicate fuel flow. Excessive wear on the aircraft adapter and the fuel nozzle poppet will result if the handle is allowed to float in the unlocked position.

15. Once fuel flow has been established, exercise the aircraft's precheck system. (plane captain)

Note

- The precheck system simulates the completion of a complete refueling by closing all of the tank inlet shutoff valves within the aircraft. All fuel flow into the aircraft should stop within a few seconds

to 1 minute of actuating the precheck system. The refueling station meter is the primary means of detecting that fuel flow has stopped and precheck was successful. If a meter is not available, successful precheck can be confirmed by observing the jerk and stiffening that occurs in the refueling hose and/or the pressure spike that occurs at the refueling station.

- Aircraft may be cold refueled if it fails precheck, but special procedures are required. See appropriate aircraft NATOPS manual. This should be done only if it is an operational necessity.

16. Fuel aircraft as directed by plane captain. Plane captain shall monitor aircraft vents, tank pressure gauge(s) and/or warning lights as necessary.
17. When directed by the plane captain, release deadman control. (station operator)
18. Rotate the nozzle flow control handle into the OFF and fully locked position. (nozzle operator and verified by the station operator)

WARNING

Failure to lock the flow control handle in the OFF position can contribute to a failure of the nozzle's safety interlock system and could result in a fuel spray or spill.

19. Disconnect nozzle from the aircraft adapter. (nozzle operator)
20. Stow the pantograph or hose. (nozzle operator and station operator)
21. Complete paperwork. (nozzle and station operators).

12.3.2 Overwing (Gravity) Refueling

12.3.2.1 Personnel Requirements. Overwing (gravity) refueling aircraft in static condition at fueling hydrants, direct refueling stations, skid mounts, and other fuel service units, requires three people — a nozzle operator, a fuel system operator, and a fire extinguisher operator.

12.3.2.2 Procedures

WARNING

Overwing refueling with the aircraft's engines operating is NOT authorized.

Aircraft refueling tasks are to be performed in the following sequence and verified by the pit station operator:

1. Recirculate (flush) the station and take fuel sample for quality control checks as appropriate. (station operator)

WARNING

Fuel shall be recirculated/flushed through refueling hose and nozzle and tested for contamination prior to refueling the first aircraft each day. Fueling shall not begin until acceptable results have been obtained, i.e., clear and bright with no visible sediment (see Chapter 9). Failure to provide clean, dry fuel to the aircraft can adversely affect safety-of-flight.

Note

Recirculate the refueling station and take samples with the SPR nozzle in place, then replace the SPR with overwing nozzle immediately before commencing refueling operations.

2. Check for "hot brake" condition. (plane captain)

Note

Hot brake check is applicable to fixed-wing aircraft only.

3. Tow aircraft into the direct refueling station. Position and chock it. (plane captain)
4. Secure all electronic and electrical switches on the aircraft not required for fueling. (plane captain)
5. Verify that the fire extinguisher is at the refueling point. (station operator)

6. Attach bonding cable between the refueling equipment and the aircraft. (plane captain)

WARNING

Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until evolution has been completed or refueling has been stopped for an emergency. This means:

— NO aircraft engines or auxiliary power units shall be started or stopped. External power shall NOT be connected, disconnected, or switched on or off.

— Changing the aircraft's electrical power status can create significant ignition sources.

7. Zero the refueling station's meter or note the station's totalizer reading. (station operator)

8. Pull out the pantograph (or reel out hose) and place in proper position for refueling. (nozzle operator and station operator)

9. Bond the overwing nozzle to the aircraft as shown in Figure 12-4 and then remove the filler cap from the aircraft. (nozzle operator)

WARNING

Always bond the nozzle to the aircraft before the fill cap is removed. This connection shall remain in place until the entire fueling operation is complete. Failure to bond nozzle and/or maintain contact can result in a dangerous static spark inside the fuel tank.

10. Insert overwing nozzle into the aircraft's refueling port and maintain metal-to-metal contact between the overwing nozzle and the aircraft's refueling port throughout the entire fueling operation. (nozzle operator)

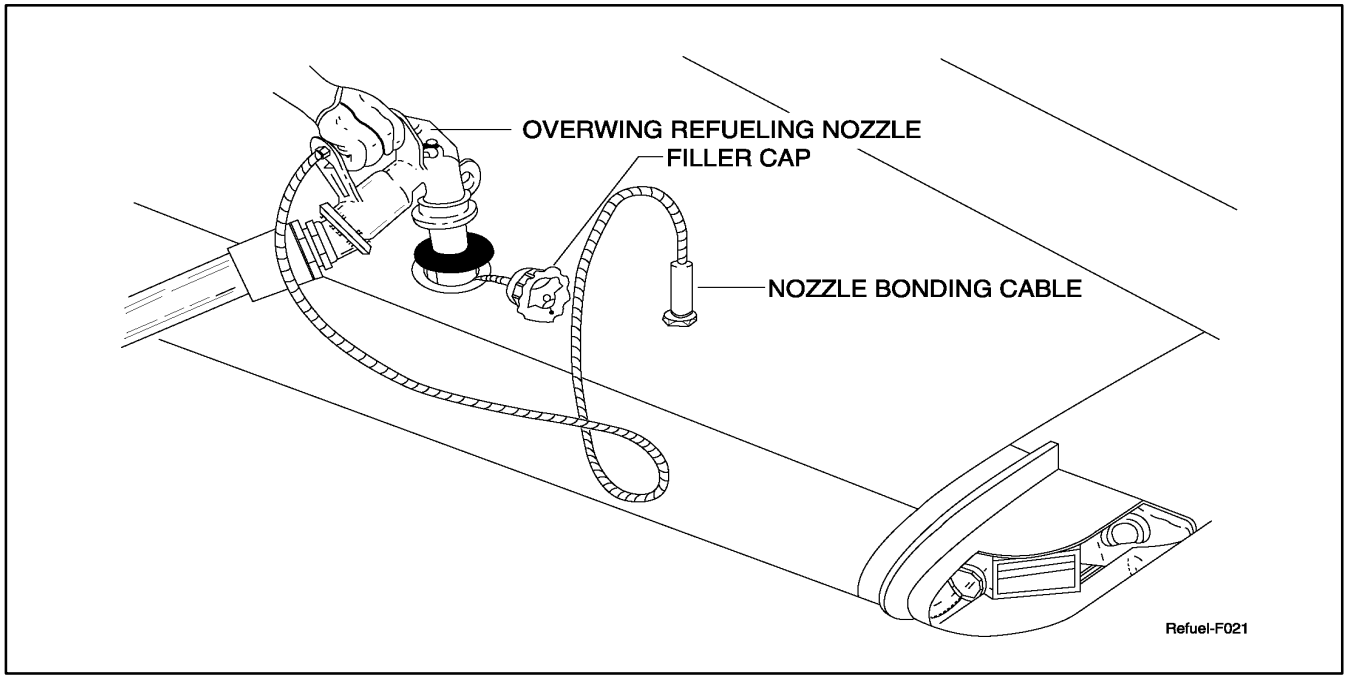


Figure 12-4. Electrical Bonding of Overwing Refueling Nozzle to Aircraft

11. Upon receiving signals from nozzle operator/ plane captain that hook-up has been completed and they are ready to begin fueling operation, station operator actuates the remote, hand-held, deadman control.

WARNING

Deadman controls shall not be blocked open or otherwise compromised since this defeats the purpose of the device and can lead to a catastrophic accident.

12. Nozzle operator shall squeeze the handle on the overwing nozzle to initiate fuel flow and fuel aircraft as directed by plane captain. Plane captain shall monitor aircraft vents, tank pressure gauge(s), and/or warning lights as necessary.

13. When directed by the plane captain, release deadman control. (station operator)

14. Disconnect nozzle bonding wire from the aircraft. (nozzle operator)

15. Stow the pantograph or hose. (nozzle operator and station operator)

16. Complete paperwork. (nozzle and station operators)

12.4 TRUCK OPERATIONS

12.4.1 Truck Fill Stands

12.4.1.1 Personnel Requirements. The operation of truck fill stands is a one-person operation for trucks equipped with high-level alarms/shut-off and deadman control valves at the fill stand. This is a two-man operation for equipment not having these devices.

WARNING

Top loading shall not be performed. This method of filling tanks is extremely dangerous because of the highly flammable vapors and static charges produced.

WARNING

Personnel shall not be on top of the truck during the filling operation.

12.4.1.2 Procedures. Trucks shall be filled in the following sequence:

1. Position truck, turn off lights, place gear shift in neutral/park position, set parking brake, stop engine, and turn off all switches (except for necessary alarms, etc.).

2. Verify product and estimate the amount of product to be loaded.

3. Connect bond or high-level control cable.

4. Connect delivery nozzle to truck's bottom loader.

5. Set meter and enter necessary information on truck fill order or other form.

6. Start filling operation slowly.

CAUTION

Trucks that have been completely drained shall be minimally filled (500 to 1,000 gallons) using another truck set at the low flow rate in order to cover the bottom inlet valve inside the truck's tank.

7. After tank is filled, secure pump unless it has secured automatically.

8. Disconnect nozzle.

9. Disconnect bond or Scultrol jumper cable.

10. Complete paperwork.

11. Inspect truck for leaks.

12. Remove refueler to truck parking area.

12.4.2 Cold Refueling Aircraft with Trucks. Each activity shall record the movements and operations of its trucks with a log similar to Figure 12-5.

12.4.2.1 Positioning of Refueler. Positioning of refuelers to service aircraft shall be performed in the

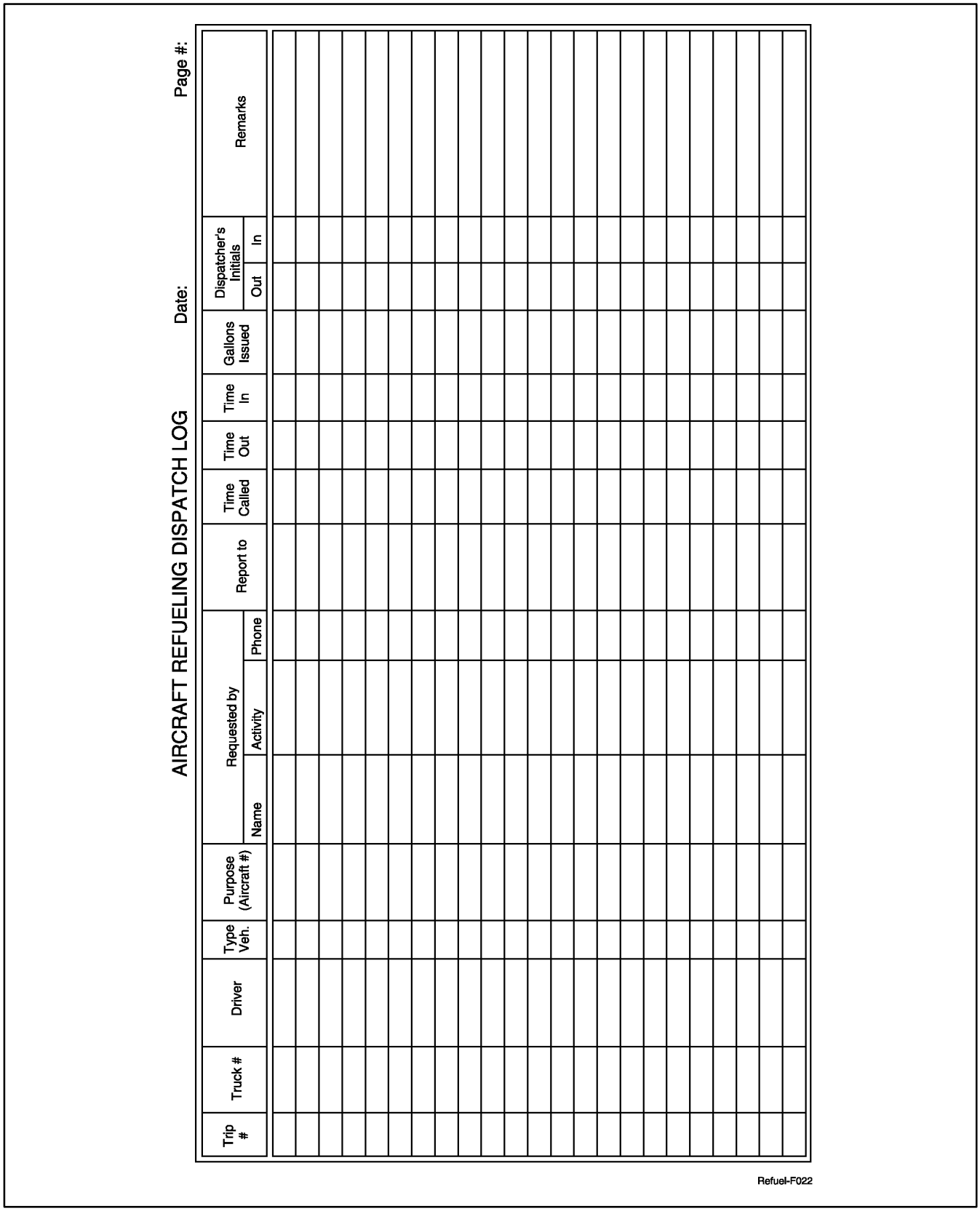


Figure 12-5. Aircraft Refueling Dispatch Log

same manner without variation so all personnel involved know exactly what to expect. Whenever possible, refuelers shall proceed down a line of parked aircraft with the driving path perpendicular to the aircraft fuselage axis, at the maximum distance hose length will permit servicing; however, at no time shall a truck approach closer than 10 feet of an aircraft. This normal refueler approach path, which is illustrated in Figure 12-6, is applicable to all fixed-wing tactical aircraft and helicopters. Normally no turns are made except at the end of the parking line. Driving between aircraft parked in line shall be avoided; however the preferred approach is not always possible. Figure 12-7 shows acceptable alternate methods when aircraft are not parked in line or hose lengths are insufficient for service. Figure 12-8 shows the safe approach paths to prop, prop/jet, and transport aircraft, while Figure 12-9 illustrates the alternate approach paths for helicopters.

Refuelers shall NEVER:

1. Be left pointing toward any part of an aircraft.

2. Be driven in the area described by straight line projections connecting points 10 feet from an aircraft's extremities. (See Figures 12-7, 12-8, and 12-9.)

3. Be backed in the proximity of aircraft without the use of a spotter and a wheel chock pre-positioned at the point where the refueler must stop.

4. Be positioned closer than 10 feet from any part of the aircraft.

The refueler shall be parked in a position on the same side of the aircraft as the aircraft's adapter so that the driver/operator has a direct line of sight to the refueling nozzle operator while actuating the deadman control.

WARNING

Failure of the driver/operator to visually observe the nozzle operator throughout the refueling operation can lead to a fuel spill and fire.

WARNING

- The hose shall not pass underneath the aircraft's fuselage to reach the SPR receptacle.

- Never operate both overwing and pressure fueling systems at the same time. Excessive pressure surges may occur on the overwing nozzle.

Note

Tailpipe temperature and the location of aircraft tank vents are important considerations when determining alternate routes and fueling positions.

12.4.2.2 Truck Preparation Procedures. Prepare truck for refueling operations as follows:

1. Recirculate (flush) the truck and take fuel sample for quality control checks as appropriate. (refueler operator)

WARNING

Fuel shall be recirculated/flushed through refueling hose and nozzle, and tested for contamination prior to refueling the first aircraft each day. Fueling shall not begin until acceptable results have been obtained, i.e., clear and bright with no visible sediment (see Chapter 9). Failure to provide clean, dry fuel to the aircraft can adversely affect safety-of-flight.

Note

Flushing the overwing nozzle requires a special receiving port that is piped to fuel storage. An alternate approach is to recirculate the refueling station and take samples with the SPR nozzle in place, then replace the SPR with overwing nozzle immediately before commencing refueling operations.

2. Drive refueler into position for refueling following approach paths discussed above. Refueler

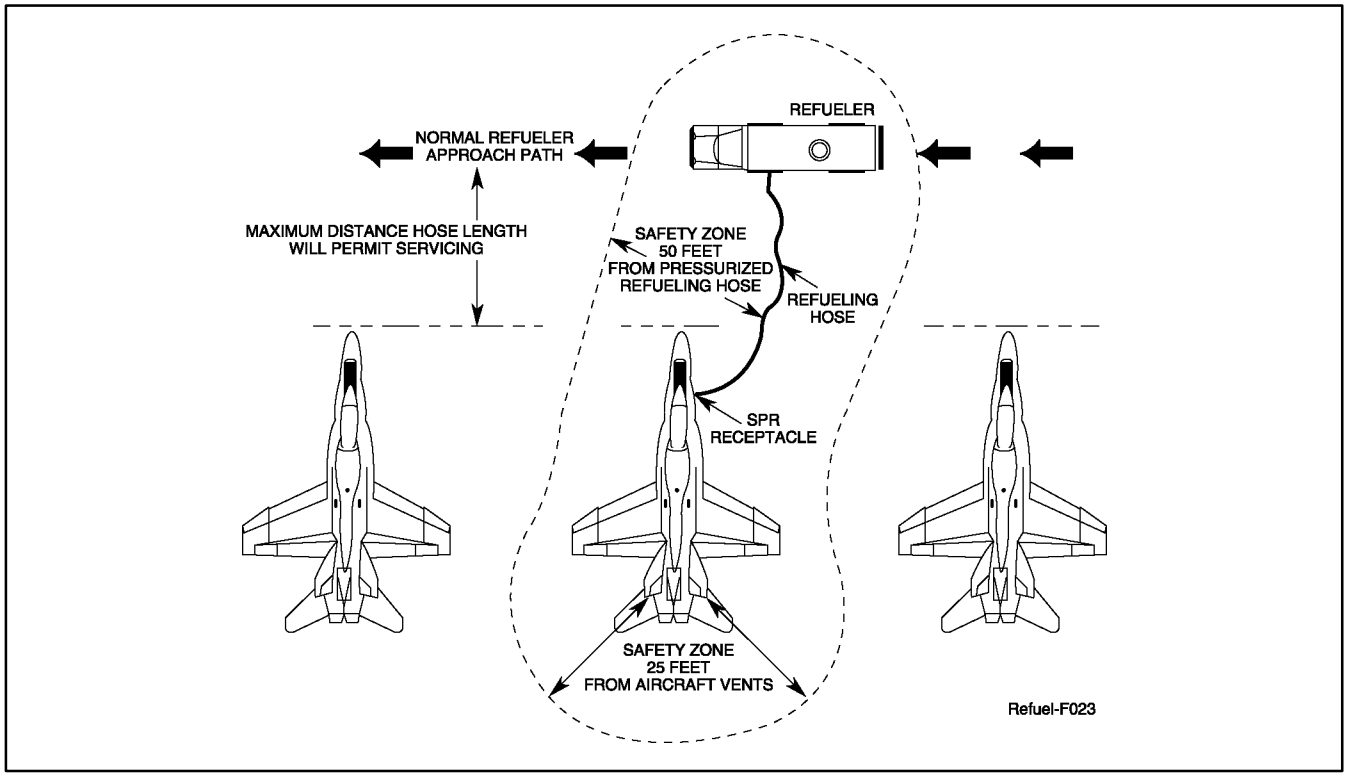


Figure 12-6. Normal Refueler Approach Path and Refueling Safety Zone

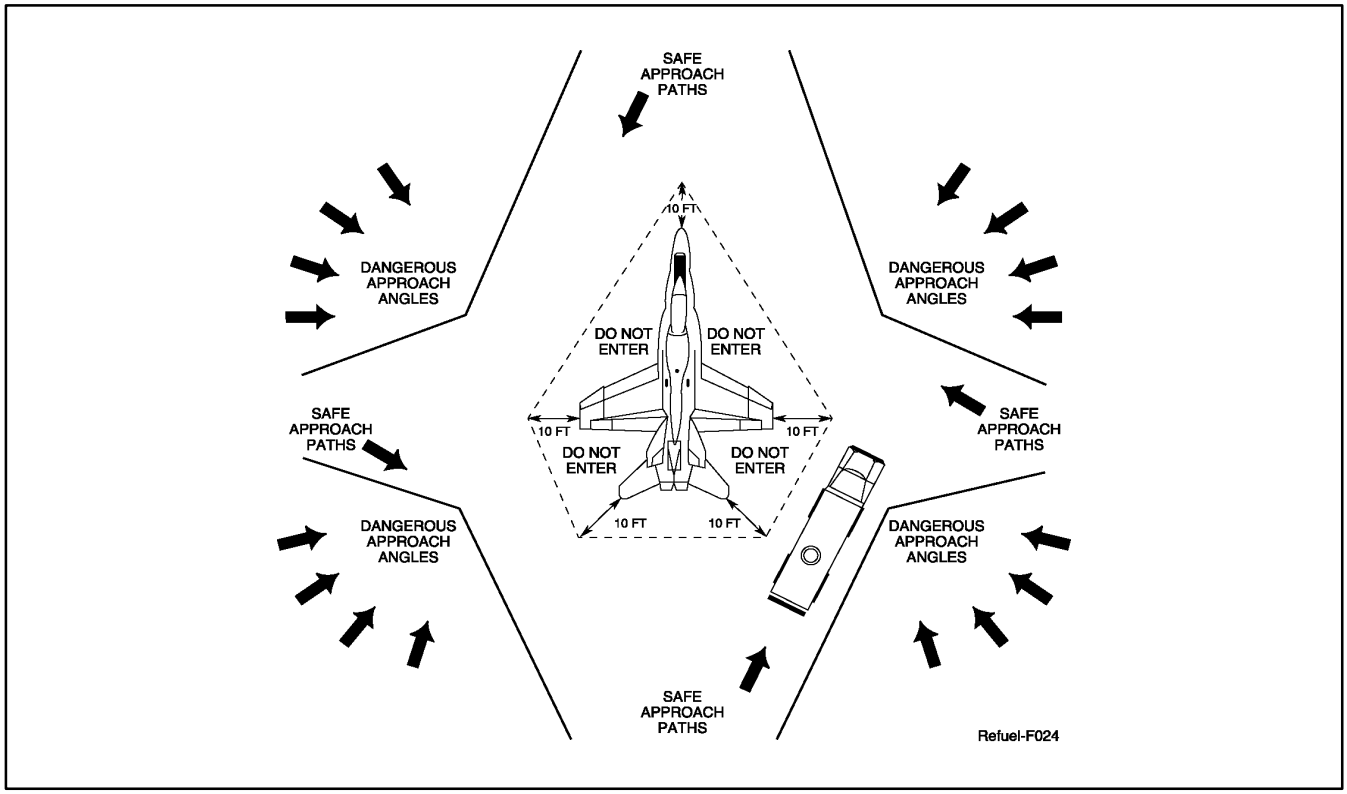


Figure 12-7. Alternate Refueler Approach Paths

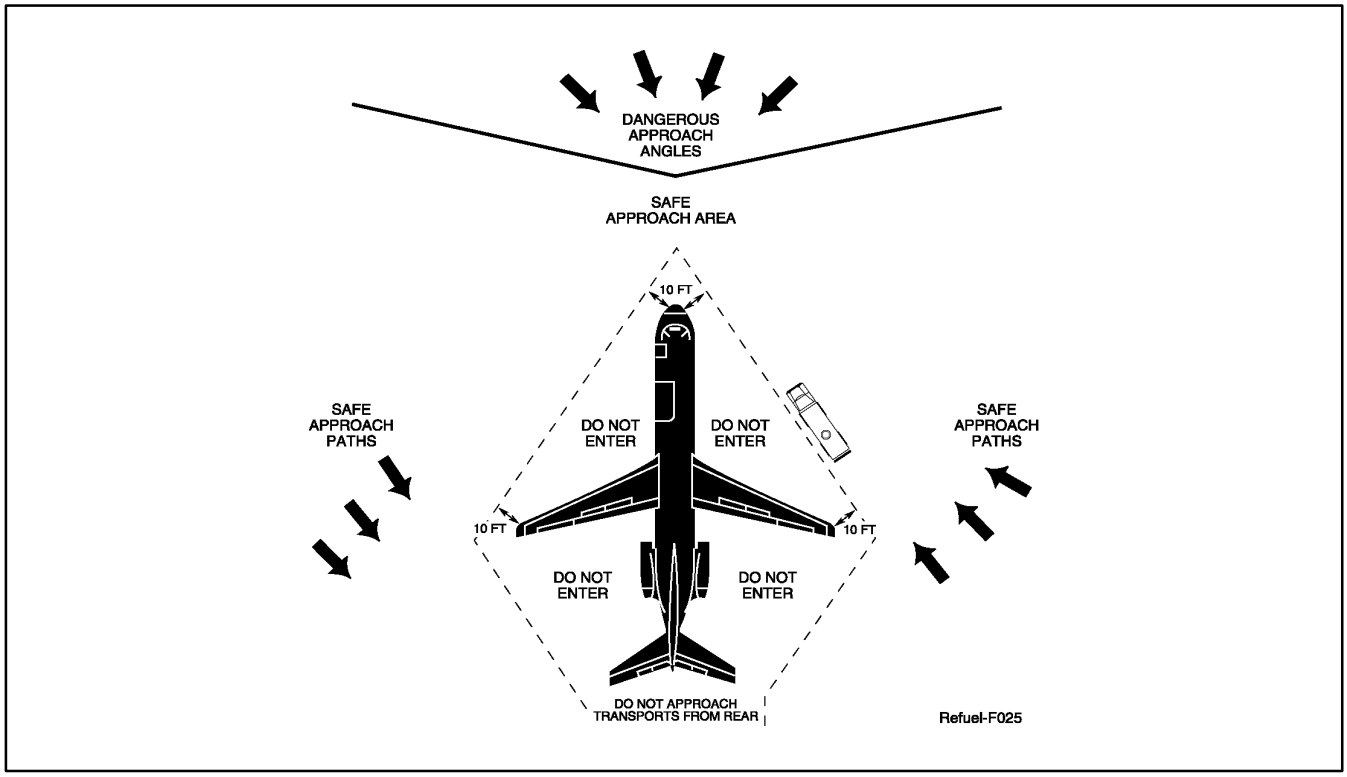


Figure 12-8. Refueler Approach to Prop, Prop/Jet, and Transport Aircraft

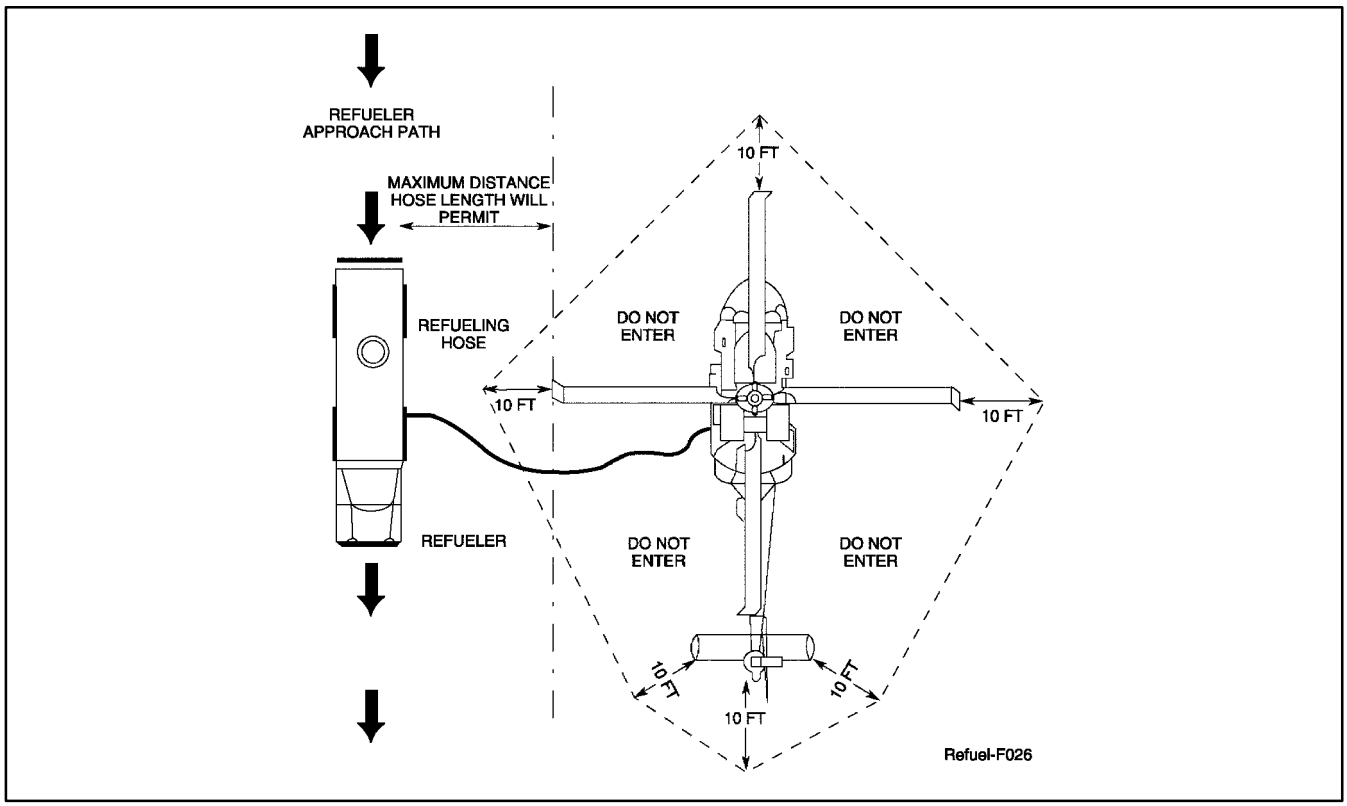


Figure 12-9. Alternate Refueler Approach to a Helicopter

shall be positioned so that it can be driven away quickly in an emergency. No wheel chocks shall be used.

3. Set brakes.

4. Place gear shift in neutral.

5. Turn off headlights and unnecessary switches. (driver/operator)

6. Open the driver's side door. It shall remain partially opened during the entire refueling operation.

WARNING

A window in the truck cab shall be kept at least partially open whenever the truck is stationary and the engine is running in order to prevent the buildup of carbon monoxide inside the cab.

12.4.2.3 Truck Pressure Refueling

12.4.2.3.1 Personnel Requirements. Cold refueling aircraft with JP-5, JP-8, or commercial Jet A or Jet A-1 via trucks is a two-person function requiring a nozzle operator and a driver/operator. In an emergency the driver/operator's first duties will be to release the deadman control and then operate the fire extinguisher while the nozzle operator disconnects the nozzle from the aircraft. The nozzle operator shall then take over responsibility for the fire extinguisher while the driver/operator reels in the hose and removes the truck from the area. Under normal conditions the nozzle operator shall assist the driver/operator in removing and replacing the hose on the refueler in order to minimize wear and damage to the hose and refueling nozzle.

CAUTION

Cold refueling aircraft with JP-4 or commercial JET B is a three-man operation requiring a dedicated fire extinguisher operator in addition to the two personnel discussed above.

12.4.2.3.2 Procedures. When truck is in position and prepared as above, conduct fueling operations as follows:

WARNING

Hot brake check shall be performed prior to positioning of the refueler.

Note

Hot brake check is applicable to fixed-wing aircraft only.

1. Secure all electronic and electrical switches on the aircraft not required for fueling. (plane captain)

2. Verify that the fire extinguisher is at the refueling point. (station operator)

3. Attach bonding cable between the refueling equipment and the aircraft. See Figure 12-10. (plane captain)

WARNING

Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until evolution has been completed or refueling has been stopped for an emergency. This means:

— NO aircraft engines or auxiliary power units shall be started or stopped.

— External power shall NOT be connected, disconnected, switched on or off.

— Changing the aircraft's electrical power status can create significant ignition sources.

4. Aircraft carrying ordnance shall be cold refueled only in areas authorized by local SOPs. Prior to refueling aircraft carrying ordnance, qualified squadron personnel shall verify that all ordnance is safed. Safed is defined as the replacement of any mechanical arming level, safety pin, electrical interrupt plug/pin, securing of armament

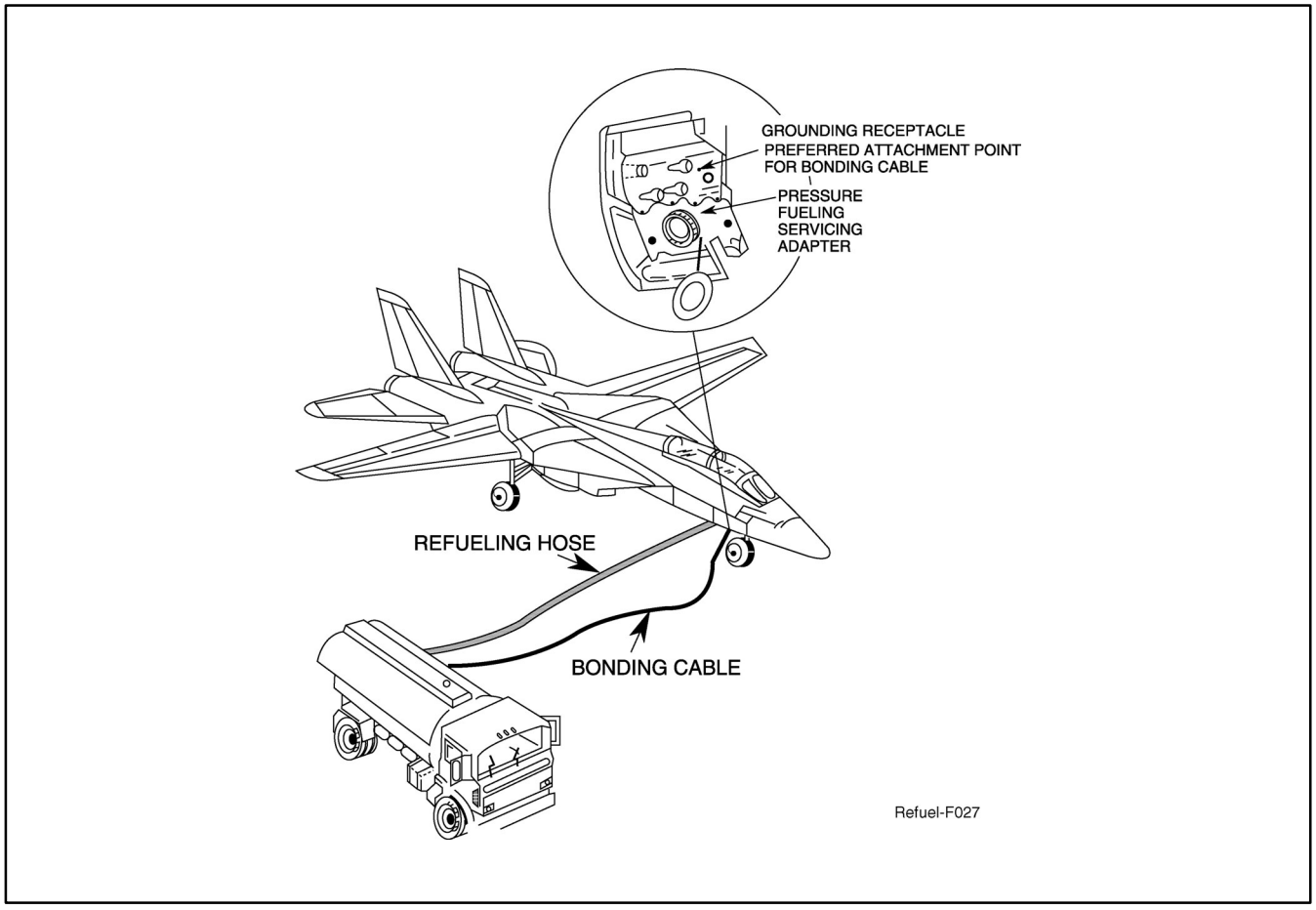


Figure 12-10. Electrical Bonding of Aircraft and Truck (Cold Refueling)

switches, and/or any appropriate action that renders the particular ordnance carried as safe.

WARNING

Refueling of aircraft with hung ordnance of any type is prohibited.

5. Pull out the hose (or pantograph) and place in proper position for refueling. (nozzle operator and refueler operator)

6. Remove refueling adapter cap from the aircraft and the dust cover from the SPR nozzle. Inspect the face of the nozzle to make sure it is clean and verify that the flow control handle is in the fully closed and locked position. (nozzle operator)

7. Visually inspect the aircraft's adapter (receptacle) for any damage or significant wear. If there is any doubt about the integrity of the adapter, use the adapter go/no-go gauge (NSN 1RW-5220-01-301-9247) or alternate go/no-go gauge (NSN 5220-01-343-1688) to determine acceptability. (nozzle operator)

WARNING

A worn or broken adapter can defeat the safety interlocks of the refueling nozzle permitting the poppet valve to open and fuel to spray or spill.

8. Lift nozzle by lifting handles, align the lugs on the nozzle with the slots on the aircraft adapter, and hook up the nozzle to the aircraft by pressing it firmly onto the adapter and rotating it clockwise to a positive stop. (nozzle operator)

WARNING

Nozzle must seat firmly on the adapter and not be cocked. Cocking can indicate a malfunction of the nozzle's safety interlock system, which can lead to a fuel spray or spill.

9. Zero the refueling meter or the totalizer reading. (refueler operator)

10. Rotate the nozzle flow control handle to the FULL OPEN position. The handle shall rotate 180 degrees to ensure that the poppet valve is fully open and locked. (nozzle operator)

WARNING

The flow control handle of the single point pressure refueling nozzle shall be placed in either of two locked positions — fully open or fully closed. The handle is NOT to be used as a flag to indicate fuel flow. Excessive wear on the aircraft adapter and the fuel nozzle poppet will result if the handle is allowed to "float" in the unlocked position.

11. Upon receiving signals from nozzle operator/ plane captain that hook-up has been completed and they are ready to begin fueling operation, refueler operator actuates the remote, hand-held, deadman control.

WARNING

Deadman controls shall not be blocked open or otherwise compromised since this defeats the purpose of the device and can lead to a catastrophic accident.

12. Once fuel flow has been established, exercise the aircraft's precheck system. (plane captain)

Note

- The precheck system simulates the completion of a refueling by closing all of the tank inlet shutoff valves within the aircraft. All fuel flow into the aircraft should stop within a few seconds to 1 minute of actuating the precheck system. The primary means of detecting that fuel flow has stopped and precheck was successful is via the refueling station meter. If a meter is not available, successful precheck can be confirmed by observing the jerk and stiffening that occurs in the refueling hose and/or the pressure spike that occurs at the refueling station.

- Aircraft may be cold refueled if it fails precheck, but special procedures are required. See appropriate aircraft NATOPS Manual. This should be done only if it is an operational necessity.

13. Fuel aircraft as directed by plane captain. Plane captain shall monitor aircraft vents, tank pressure gauge(s), and/or warning lights as necessary.

14. When directed by the plane captain, release deadman control. (refueler operator)

15. Rotate the nozzle flow control handle into the OFF and fully locked position. (nozzle operator and verified by the refueler operator)

WARNING

Failure to lock the flow control handle in the OFF position can contribute to a failure of the nozzle's safety interlock system and, ultimately, a fuel spray or spill.

16. Disconnect nozzle from the aircraft adapter. (nozzle operator)

17. Stow the pantograph or hose. (nozzle operator and refueler operator)

18. Complete paperwork. (nozzle and refueler operators)

12.4.2.4 Truck Overwing Refueling

12.4.2.4.1 Personnel Requirements. Overwing refueling via truck is a three-person operation requiring a nozzle operator, a driver/operator, and a fire extinguisher operator.

12.4.2.4.2 Procedures. Once the refuel truck is in position and prepared as stated in paragraphs 12.4.2.1 and 12.4.2.2, conduct fueling operations as follows:

WARNING

Hot brake check shall be performed prior to positioning of the refueler.

Note

Hot brake check is applicable to fixed-wing aircraft only.

1. Secure all electronic and electrical switches on the aircraft not required for fueling. (plane captain)
2. Verify that the fire extinguisher is at the refueling point. (station operator)
3. Attach bonding cable between the refueling equipment and the aircraft. (See Figure 12-10.) (plane captain)

WARNING

Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until evolution has been completed or refueling has been stopped for an emergency. (For example, NO aircraft engines or auxiliary power units shall be started or stopped and external power shall NOT be connected, disconnected, switched on or off.) Changing the aircraft's electrical power status can create significant ignition sources.

4. Zero the refueling station's meter or note the station's totalizer reading. (refueler operator)
5. Pull out the hose (or pantograph) and place in proper position for refueling. (nozzle operator and refueler operator)
6. Bond the overwing nozzle to the aircraft as shown in Figure 12-4 and then remove the filler cap from the aircraft. (nozzle operator)

WARNING

Always bond the nozzle to the aircraft before the filler cap is removed. This connection shall remain in place until the entire fueling operation is complete. Failure to bond nozzle and/or to maintain contact can result in a dangerous static spark inside the fuel tank.

7. Insert overwing nozzle into aircraft's refueling port and maintain metal-to-metal contact between the overwing nozzle and the aircraft's refueling port throughout the entire fueling operation. (nozzle operator)
8. Upon receiving signals from nozzle operator/ plane captain that hook-up has been completed and the fueling operation is ready to begin, refueler operator actuates the remote, hand-held, deadman control.

WARNING

Deadman controls shall not be blocked open or otherwise compromised since this defeats the purpose of the device and can lead to a catastrophic accident.

9. Nozzle operator shall slowly squeeze the handle on the overwing nozzle to initiate fuel flow and fuel aircraft as directed by plane captain. Plane captain shall monitor aircraft vents.
10. When directed by the plane captain, release deadman control. (station operator)
11. Disconnect nozzle bonding wire from the aircraft. (nozzle operator)
12. Stow the pantograph or hose. (nozzle operator and station operator)
13. Complete paperwork. (nozzle and station operators)

12.4.3 Refueler Parking. All activities shall require that refueling vehicles be constantly attended whenever the engine is operating. Operator is considered in attendance when performing tasks directly associated with fueling an aircraft; e.g., assisting aircraft refueling operator, transporting hose,

etc. If for any reason the operator leaves his/her truck unattended, he/she shall first:

1. Drive truck clear of aircraft.
2. Place air brake in ON and LOCKED position, if applicable.
3. Set parking brakes.
4. Direct front wheels to an open unobstructed area.
5. Stop engine.
6. Chock the drive wheels.

12.5 FUELING WITH ENGINES OPERATING (HOT REFUELING)

Hot refueling shall be performed only when operational requirements dictate since this operation is significantly more dangerous and costly — both in terms of fuel and manpower expenditures. Pressure hot refueling only shall be performed.

12.5.1 Personnel Requirements. A minimum of three ground crew personnel are required for each hot refueling operation. All personnel performing hot refueling operations shall be fully trained and qualified in accordance with Chapter 8 and local instructions. The duties of each of these personnel are listed in the following paragraphs.

WARNING

If the station is configured such that the deadman control operator does not have a direct line-of-sight of both the aircraft pilot and the nozzle operator, a fourth person (refueling coordinator) is mandatory.

1. One station operator. Duties include actual operation of the deadman control.
2. One nozzle operator. Duties include the performance of necessary aircraft refueling checks such as exercising of the shutoff valves precheck system and vent and refueling panel monitoring. The nozzle operator shall remain at the nozzle throughout the refueling and leave only to conduct necessary vent checks.
3. One fire watch. Duty is to man the fire extinguisher throughout the entire refueling operation.
4. One refueling coordinator (plane captain). Duties include directing all movements of the aircraft and coordinating hand signals between fuel crew and pilot.

Note

When the deadman control operator has direct line-of-sight of both the aircraft pilot and the nozzle operator, the refueling coordinator's duties may be performed by the nozzle operator.

12.5.2 Equipment Requirements. The following equipment is the absolute minimum required to conduct hot refueling operations at shore activities.

1. One fuel service unit, such as a direct refueling station, mobile refueler, hose cart, TAFDS, and HERS. This unit shall possess all of the required features and systems listed in Chapter 11 for systems/facilities that refuel aircraft, e.g., filter/separator, fuel monitor. This fuel servicing unit shall be grounded (earthed) through a connection that offers less than 10,000 ohms resistance. The servicing system's fuel supply tank(s) shall be located at least 50 feet from any part of the aircraft (wings, rotor blades, etc.) being serviced.

WARNING

The fuel service unit shall have a completely operational deadman control. The deadman control shall cut off the flow of fuel to the aircraft immediately (within two seconds) upon release. Leakage past this valve with the deadman in the released position shall not exceed 1 gallon in 5 minutes.

2. A fixed or portable pantograph system (excluding TAFDS and HERS systems).
3. One bonding/grounding cable. New direct refueling stations are designed with the bonding/grounding cable built into the pantograph and along the hose. A separate bonding cable is

therefore not needed with these systems. If a continuity check proves the resistance to be 10,000 ohms or less, the requirement for continuity is satisfied.

WARNING

Both the system (truck) and aircraft must be grounded to the earth as well as bonded to each other when conducting hot refueling operations with trucks.

4. Aircraft wheel chocks or similar restraining device.
5. Sound-attenuating ear protectors, goggles, cranials, long-sleeved shirts, and pants for each crewmember. Personnel shall not wear shoes that have nails or other metal devices on the soles that might cause sparking.
6. A fire extinguisher for each aircraft being refueled (see NATOPS Aircraft Firefighting and Rescue Manual, NAVAIR 00-80R-14).

WARNING

All ground personnel involved in the hot refueling operation shall be qualified in the operation of the fire extinguishing equipment in use.

7. One emergency dry-breakaway coupling. This device shall be attached to the refueling hose near the pantograph (on direct refueling stations) or attachment point to the fuel servicing unit.

12.5.3 Hot Refueling Procedures

12.5.3.1 Initial Hot Refueling Procedures Prior to Entering the Refueling Area. The following steps shall be accomplished prior to the aircraft entering the hot refueling area:

1. Check for hot brake condition. (plane captain)

WARNING

Hot refueling shall not be performed if a hot brake condition exists.

Note

Hot brake check is applicable to fixed-wing aircraft only.

2. Recirculate (flush) the station or mobile refueler and take fuel sample for quality control checks as appropriate. (station operator)

WARNING

- Fuel shall be recirculated/flushed through refueling hose and nozzle and tested for contamination prior to refueling the first aircraft each day. Fueling shall not begin until acceptable results have been obtained; e.g., clear and bright with no visible sediment (see Chapter 9). Failure to provide clean, dry fuel to the aircraft can adversely affect safety-of-flight.

- No nozzle samples shall be taken after the aircraft has taxied into the designated hot refueling area/direct fueling station. Sampling increases the possibility of a fuel spill.

3. The area shall be policed for FOD.
4. Ground crew shall wear equipment and clothing described in paragraph 12.5.2, step 5.
5. Qualified squadron personnel shall verify all ordnance is safed. Safed is defined as the replacement of any mechanical arming level, safety pin, electrical interrupt plug/pin, securing of armament switches, and/or any appropriate action that renders the particular ordnance carried as safe.

WARNING

- Hot refueling of explosive loaded combat aircraft is prohibited. Dummy ordnance, practice ordnance containing only flash or impact signal cartridges, training missiles without live warheads and motors, internally carried pyrotechnics and SUS charges, aircraft-peculiar cartridge actuated devices, and dearmed internally mounted guns loaded with target practice ammunition are excluded from this requirement; however, this type of ordnance shall be safed prior to initiating refueling.
- Hot refueling of aircraft with hung ordnance of any type is prohibited.
- Explosive loaded combat aircraft are not permitted in the fuel pits.
- Hot refueling of aircraft with pods/dispensers loaded with decoy flares is prohibited.

12.5.3.2 Hot Refueling Procedures in the Refueling Area. Once the aircraft has been determined ready for entry into the hot refueling area, the following steps shall be performed:

1. The aircraft shall be taxied into the hot refueling area in accordance with local SOPs. The aircraft shall enter the area with the refueling receptacle on the side of the aircraft nearest the pantograph or hose. Once properly positioned, the aircraft shall be chocked.

WARNING

- Servicing the AV-8B's water injection system/tank is NOT authorized in the refueling area.
- Pantograph must be extended to a sufficient distance for the emergency dry breakaway device to work properly without the pantograph interfering with movement of the aircraft (see Figure 12-11).

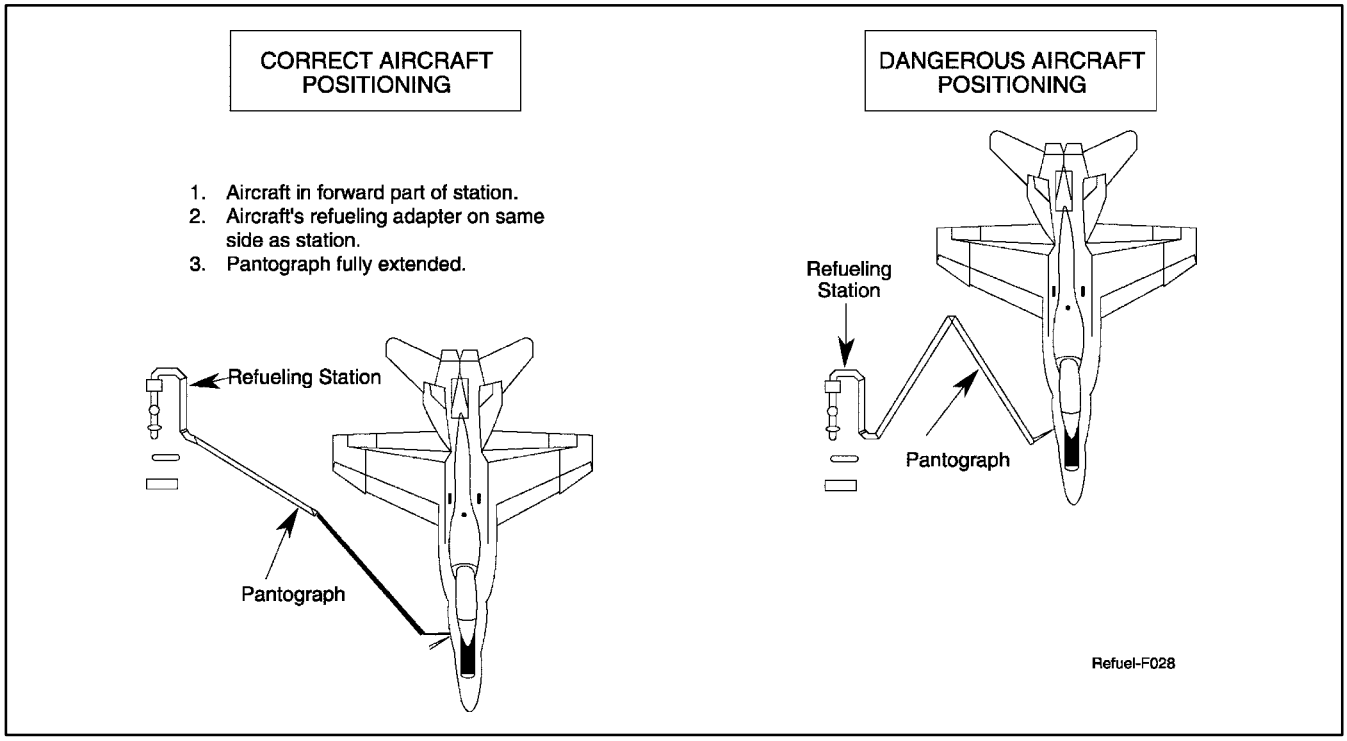


Figure 12-11. Positioning of Aircraft for Pantograph Refueling

WARNING

- The hose or pantograph shall not pass underneath the aircraft to reach the SPR receptacle. This will interfere with the operation of the emergency dry break coupling or may result in the severing of the hose/pantograph in the event of malfunction or failure of the aircraft's landing gear.
- Crew changes and hot seating shall not be conducted in the fuel pits.
- Discontinue refueling immediately if any leaks or spills occur during the refueling operation.
- The deadman control operator shall have a direct line-of-sight to the refueling nozzle operator at the aircraft receptacle whenever he/she is actuating the deadman control.
- If either the primary or secondary shut-off valve test discloses a failure, the hot refueling operation shall be discontinued immediately.
- Aircraft canopy and helicopter side doors (if installed) shall remain closed during the entire refueling evolution. Aircraft refueling operations shall be secured if canopy is opened.
- Exceptions:
  - — Rear cargo doors and/or doors on opposite side of aircraft from the refueling adapter may be open, provided the refueling hose is positioned so that it is unlikely fuel sprays from nozzle/adapter malfunction or hose rupture will enter aircraft passenger/cargo/cockpit compartment(s).
  - — The AV-8B aircraft may be hot refueled with the canopy open at the pilot's discretion when high temperatures and humidity dictate since the aircraft's environmental control system does not operate with weight on wheels.

2. Pilot shall secure all unnecessary electronic and electrical equipment not required for refueling.
3. Verify that manned firefighting equipment is properly positioned to the refueling operation. (station operator)
4. Bond the aircraft to the refueling equipment and ground the aircraft to an earth ground with a resistance to ground value of 10,000 ohm or less. (plane captain)

Note

- Unlike cold refueling systems, aircraft with engines or APU running generate additional static electricity that must be bled to ground.
- In direct fueling systems, both bonding and grounding are normally accomplished simultaneously with the attachment of the refueling nozzle to the aircraft. The nozzle/hose/pantograph system provides a continuous electrical path between the aircraft and the fueling equipment that is grounded to Earth. (See Figure 12-3.)
- If bonding and grounding are not established in the direct fueling station through the nozzle/hose/pantograph system, a separate cable that is both bonded to the fueling equipment and grounded to a 10,000 ohms or less earth ground must be provided. The grounding receptacle near the aircraft's refueling adapter should be used; if this is not possible, connection should be made to bare metal on the aircraft.
- When hot refueling from refueling trucks, the truck shall be connected to an Earth ground of 10,000 ohms or less, and the truck and the aircraft shall be bonded to each other. If a portable or permanently anchored pantograph has been properly earthed and configured there is electrical continuity between the nozzle and the pantograph. The truck's bonding cable shall be attached to this pantograph.
- Primary aircraft taxi directors shall be aircraft crew chiefs, plane captains,

trained and qualified squadron personnel, or visiting aircraft line personnel when hot refueling aircraft at fixed facilities.

5. Pull out the pantograph (or reel out hose) and place in proper position for refueling. (nozzle operator and station operator)

6. Remove refueling adapter cap from the aircraft and the dust cover from the SPR nozzle. Inspect the face of the nozzle to ensure it is clean and verify that the flow control handle is in the fully closed and locked position. (nozzle operator)

7. Visually inspect the aircraft's adapter (receptacle) for any damage or significant wear. If any doubt about the integrity of the adapter exists, use the adapter go/no-go gauge (NSN 1RW-5220-01-301-9247) or alternate go/no-go gauge (NSN 5220-01-343-1688) to determine acceptability.

WARNING

A worn or broken adapter can defeat the safety interlocks of the refueling nozzle permitting the poppet valve to open and fuel to spray or spill.

8. Lift nozzle by lifting handles, align the lugs with the slots on the aircraft adapter and hook up to the aircraft by pressing firmly onto the adapter and rotating it clockwise to a positive stop. (nozzle operator)

WARNING

The nozzle must be seated firmly on the adapter and not be cocked. Cocking can indicate a malfunction of the nozzle's safety interlock system, which can lead to a fuel spray or spill.

9. Zero the refueling meter or note the totalizer reading.

10. Upon receiving signals from the nozzle operator/plane captain that hook-up has been completed and the fueling operation is ready to begin, station operator actuates the remote, hand-held, deadman control.

WARNING

- Deadman controls shall not be blocked open or otherwise inhibited. This defeats the purpose of the device and can lead to a catastrophic accident.

- Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until evolution has been completed or refueling has been stopped for an emergency; e.g., NO aircraft engines or auxiliary power units shall be started or stopped and external power shall NOT be connected, disconnected, or switched on or off. Changing the aircraft's electrical power status can create significant ignition sources.

11. When hose is fully charged, rotate the nozzle flow control handle to the FULL OPEN position. The handle shall rotate 180 degrees to ensure that the poppet valve is fully open and locked. (nozzle operator)

WARNING

The flow control handle of the single point pressure refueling nozzle shall be placed in either of two locked positions — fully open or fully closed. The handle is NOT to be used as a flag to indicate fuel flow. Excessive wear on the aircraft adapter and the fuel nozzle poppet will result if the handle is allowed to float in the unlocked position.

12. Once fuel flow has been established, exercise the aircraft's precheck system. (qualified personnel)

Note

- The precheck system simulates completion of a refueling by closing all tank inlet shutoff valves within the aircraft. All fuel flow into the aircraft should stop within

a few seconds to 1 minute of actuating the precheck system. The primary means of detecting that fuel flow has stopped and precheck was successful is via the refueling station meter. If a meter is not available, successful precheck can be confirmed by observing the jerk and stiffening that occurs in the refueling hose and/or the pressure spike that occurs at the refueling station.

- Aircraft may be cold refueled if it fails precheck, but special procedures are required. See appropriate aircraft NATOPS Manual. This should be done only as an operational necessity.

13. Fuel aircraft as directed by the plane captain. The plane captain shall monitor aircraft vents, tank pressure gauge(s), and/or warning lights as necessary.

14. When directed by the plane captain, release deadman control.

15. Rotate the nozzle flow control handle into the OFF and fully locked position. (nozzle operator and verified by the station operator)

WARNING

Failure to lock the flow control handle in the OFF position may result in a fuel spray or spill.

16. Disconnect nozzle from the aircraft adapter. (nozzle operator)

17. Stow the pantograph or hose. (nozzle operator and station operator)

18. Complete paperwork. (nozzle and station operators)

19. Ensure area is clear of equipment and personnel.

12.6 MULTIPLE SOURCE REFUELING

Normally, only one refueling truck at a time is used to service aircraft; however, there are situations when multi-truck or truck and hydrant servicing is considered desirable, especially when very large aircraft must be refueled. The advantage to multiple source refueling is reduced aircraft turnaround time. The aircraft's NATOPS Manual, USAF Technical Order, or equivalent aircraft servicing manual shall be consulted for specific guidelines and instructions on multiple source refueling before such operations are performed. In addition, the instructions and guidelines on multi-source refueling contained in USAF Technical Order 00-25-172 shall be followed since the vast majority of aircraft involved belong to the USAF. This USAF Technical Order is available from WR-ALC/MMEDT, Robins AFB, Georgia 31098; while specific USAF Aircraft Servicing Technical Orders may be obtained from SA-ALC/MMEDT, Kelly AFB, San Antonio TX 78241.

12.7 PIGGYBACK REFUELING

Piggyback refueling is a special refueling process sometimes used to refuel very large aircraft such as C-5As or E-6As. Two or more refueling trucks are used. One truck is attached to the aircraft's refueling adapter and other trucks are used to refuel this truck while it continuously refuels the aircraft. This is a potentially dangerous operation and shall be conducted only with properly configured vehicles and under the direct supervision of the FMO. In addition to all of the items required by paragraph 11.3.2 (filter/separator, monitor, relaxation chamber) these vehicles shall have both high- and low-level alarms and shutoff systems in place and fully operational.

WARNING

- High-level alarm and shutoff are essential to preventing tank overfill.

- Low-level alarm and shutoff are essential to preventing pump cavitation and/or the pumping of air into the aircraft. These can lead to catastrophic static electric discharges.

Each refueling operation, (e.g., the refueling of the aircraft and the refueling of the truck) shall be performed following the procedures for cold refueling with a truck (see paragraph 12.4.2). A minimum of five people will be needed for these two operations since one

person manning a fire extinguisher is sufficient to cover both operations. A detailed local instruction that delineates each individual's responsibilities and duties shall be written to cover this operation.

12.8 TRANSFERRING FUEL FROM ONE AIRCRAFT TO ANOTHER

Some special purpose operations have been developed in which fuel is removed from an aircraft and directly loaded into another aircraft (or ground vehicle). As discussed in paragraph 12.12 of this chapter, aircraft defueling is a very dangerous and demanding operation. In addition, the immediate reuse of fuel removed from an aircraft without proper filtration and handling can adversely affect safety-of-flight. Only NAVAIR approved transfer operations are authorized. Appropriate safety precautions shall be observed at all times during these operations. Specific examples of approved operations listed below:

1. Refueling aircraft, fuel storage bladders, or ground vehicles from KC-130 aircraft.

2. Refueling aircraft, fuel storage bladders, or ground vehicles from CH-53 aircraft.

3. Transfer of fuel between aircraft using Plane-to-Plane Transfer Cart. For a detailed description of this equipment and procedures for its use refer to Chapter 6, paragraph 6.2.10.2 of this NATOPS Manual.

12.9 REFUELING AIRCRAFT WITH AUXILIARY POWER UNIT (APU) RUNNING

The aircraft APU may be used to supply electrical power for pressure refueling on military aircraft so equipped and commercial aircraft (when the procedure is approved by the FAA for the carrier's aircraft in commercial operations). This operation is not considered "hot refueling"; however, the following precautions shall be observed in addition to the normal refueling procedures:

1. One person shall remain outside the aircraft within 10 feet of the APU exhaust with a fire extinguisher of the size specified by the Fire Chief.

2. The fuels operator will verify that the aircraft is grounded.

3. One person shall be located at the GTC controls in the cockpit.

4. Intercom shall be established between cockpit and personnel performing refueling to ensure immediate shutdown in the event of emergency.

5. Personnel in the vicinity of the aircraft shall wear sound-attenuating ear protectors.

Note

For P-3 aircraft that have APUs equipped with properly functioning fire sensor/suppressor systems, which are designed to automatically extinguish APU fires, the provisions of steps 1, 3, and 4 above do not apply.

12.10 CONCURRENT ON-LOADING/OFF-LOADING AND REFUELING OF AIRCRAFT

Station/Activity COs may grant authorization to the FMO for concurrent refueling, cargo loading, and cargo offloading (including passengers) in logistical airlift operations when minimum ground time is required to support military operations. Such authorization shall not include the loading and unloading of Class A and B explosives, but can include refueling with explosive cargo previously loaded and secured onboard.

Where concurrent refueling/loading/offloading operations are authorized, COs shall establish local regulations and procedures to ensure safety. In addition, the CO shall clearly designate one qualified person in charge of each operation. For reference purposes in this chapter, the person in charge will be called the Quick Service Supervisor (QSS), but in actual practice both his/her title and qualifications will be detailed in local regulations.

All tasks concerning the operation will be performed under the observation and control of a QSS. The QSS will be present at the site, be responsible, and have jurisdiction, authority, and coordination over all service operations including refueling trucks/equipment, fueling procedures, power units, loading/unloading equipment, and passenger management and communication systems to ensure safety of all aspects of refueling

operations. No concurrent refueling shall commence until the QSS has been identified and established in control. The refueling will commence only upon a signal from the QSS.

The following procedures and precautions shall be included in the local regulations and procedures:

1. All vehicles to be operated within a 50-foot radius of the refueling point shall be equipped with spark arrestors and designated in advance.

2. Appropriate size and type fire extinguishers as recommended by NAVAIR 00-80R-14 shall be located in the immediate vicinity.

3. A stand-by crash truck shall be required at the aircraft when passengers or patients remain onboard during concurrent refueling operations.

4. When passengers or patients are permitted to remain onboard, necessary ramps (unobstructed) shall be located in the proper position to permit evacuation. In addition, an attendant shall be present at the cabin door to enforce the no smoking rule.

5. Some large refuelings require multiple truck servicings that continue throughout the major portion of the scheduled ground time. When this coincides with operational situations of extreme urgency, it may be necessary to enplane and deplane passengers during refueling. If such extreme measures are necessary, it is recommended that these measures be contingent upon additional authorization of the CO or the Command Duty Officer. If authorization is given, care shall be taken that passenger paths avoid hazardous areas. A passenger attendant shall be assigned to prohibit passengers from entering hazardous areas.

6. Aircraft maintenance repair work or liquid oxygen servicing shall not be permitted during refueling.

7. A communication system (radio vehicle or other effective means) shall be maintained to permit the CO's designated person-in-charge to contact the crash fire truck in the event of an emergency.

8. Clear paths shall be maintained around aircraft being serviced at all times.

12.11 DEFUELING AIRCRAFT

Defueling is one of the most technically demanding and potentially dangerous operations performed by fuels personnel. Most aircraft defueling equipment has the capability of defueling an aircraft faster than the aircraft can release it. The pump's effluent (discharge) shall be regulated to balance its influent (fuel from aircraft) in order to prevent pump cavitation and/or the loss of suction, which would necessitate reflooding of the pump. Once the proper balance is achieved it must be maintained by manipulation of the valve on the downstream side of the pump throughout the defueling operation.

Defueling aircraft and operations involving defueled product shall be entrusted to only the most disciplined station operators who have received specialized training.

WARNING

Assignment of inadequately trained or inexperienced personnel to defueling operations can result in catastrophic accidents.

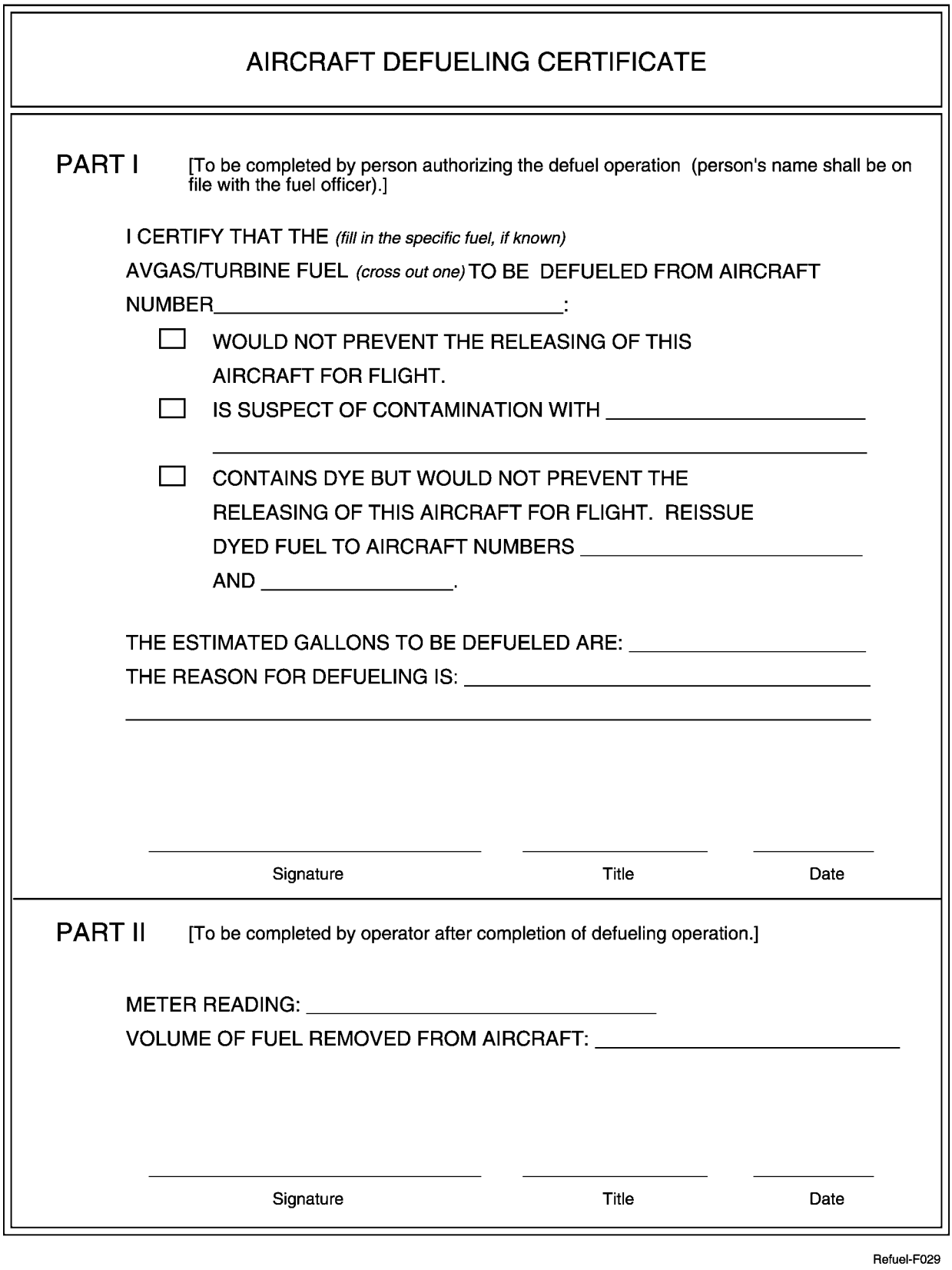
Defuelings normally have lower priority than refuelings. A defuel request for an aircraft that is leaking fuel shall be considered an emergency and handled promptly.

WARNING

The desire to satisfy customer requests for the acceleration of the process shall not be granted.

The following rules apply to every defueling operation:

1. Aircraft defueling shall be requested by an authorized representative of the squadron's CO using an Aircraft Defueling Certificate similar to Figure 12-12. The FMO of each activity shall maintain a list of these officially designated



AIRCRAFT DEFUELING CERTIFICATE

PART I [To be completed by person authorizing the defuel operation (person's name shall be on file with the fuel officer).]

I CERTIFY THAT THE *(fill in the specific fuel, if known)*
AVGAS/TURBINE FUEL *(cross out one)* TO BE DEFUELED FROM AIRCRAFT
NUMBER_____:

☐ WOULD NOT PREVENT THE RELEASING OF THIS AIRCRAFT FOR FLIGHT.

☐ IS SUSPECT OF CONTAMINATION WITH _____
_____

☐ CONTAINS DYE BUT WOULD NOT PREVENT THE RELEASING OF THIS AIRCRAFT FOR FLIGHT. REISSUE DYED FUEL TO AIRCRAFT NUMBERS _____ AND _____.

THE ESTIMATED GALLONS TO BE DEFUELED ARE: _____
THE REASON FOR DEFUELING IS: _____
_____

_____ _____ _____
Signature Title Date

PART II [To be completed by operator after completion of defueling operation.]

METER READING: _____
VOLUME OF FUEL REMOVED FROM AIRCRAFT: _____

_____ _____ _____
Signature Title Date

Refuel-F029

Figure 12-12. Aircraft Defueling Certificate

persons. This list shall be updated at least quarterly.

2. During defueling operations, any maintenance not directly required to facilitate the defueling operation is prohibited.

3. Prior to defueling aircraft carrying ordnance, qualified squadron personnel shall verify that all ordnance is safed. Safed is defined as the replacement of any mechanical arming level, safety pin, electrical interrupt plug/pin, securing of armament switches, and/or any appropriate action that renders the particular ordnance carried as safe.

WARNING

- Defueling of aircraft with hung ordnance of any type is prohibited.

- Explosive loaded combat aircraft are not permitted in the fuel pits.

4. Aircraft shall be spotted 50 feet from all structures and other aircraft. Grounding and tiedown padeyes shall be available. In addition, at least one fire extinguisher having an ANSI rating of not less than 20-B shall be available in the immediate vicinity of the operation.

5. Eductor/evacuation systems shall not be used for defueling aircraft.

6. Suspect aviation turbine fuel shall be removed from the aircraft using a defueler only (not a refueler/defueler) and deposited in a designated holding tank. Ultimate disposition will depend on the results of subsequent laboratory tests. Every effort shall be made to reclaim off-specification fuel as JP-5, F-76, or fuel oil reclaimed (FOR).

7. All fuel removed from turbine-engined aircraft shall be assumed to be a mixture of JP-4 and JP-5. Defueled turbine fuel shall therefore not be returned to JP-5 storage tanks without first confirming the flash point of the material to be 140 °F or higher.

8. Fuel containing leak detection dye can be reissued to aircraft of the same squadron as long as the squadron's requesting official signs a statement that the fuel is nonsuspect and is safe for use. Note that although refuelers/defuelers may be used to defuel dyed fuel, this may present logistics problems since it may take several loads of fuel to flush the dye out of the refueler/defueler. The fuel may appear off-color when sampled prior to issue to another squadron's aircraft.

9. The FMO shall personally decide the disposition of all defueled product. Advice is readily available from NAVPETOFF.

10. The defueling unit is required to maintain a flooded suction above the anti-vortex splash plate in its tank in order to minimize turbulence and possible ingestion of air. Historically a minimum of 1,000 gallons has been required in the defueling unit to resolve turbulence and air ingestion problems. Due to the wide variety of configurations of pump piping systems and tank sizes, 1,000 gallons of product may or may not be sufficient. It is up to the local commands to determine the minimum amount by using manufacturers' technical manuals and historical data.

11. Valve(s) that control the flow of fuel from the tank to the upstream side of the pump shall remain closed during defueling operations. This is to prevent the recirculation of product in the tank. Valve(s) may be opened to prime the pump only when the pump is not operating.

12. If during the defuel operation the pump starts to lose prime or cavitates, the operation will be discontinued until the problem is resolved and the fuel supervisor authorizes a restart.

WARNING

At no time will a restart be authorized without waiting a minimum interval of 1 MINUTE to allow dissipation of any static charges.

13. At no time shall defueler tank tops be opened during defueling operations.

14. A special log of each defueling operation shall be maintained. The following minimum information shall be contained in the log:

    a. Complete list of all squadron personnel authorized to sign defuel request forms. This list will be updated at least quarterly.

    b. All abnormal happenings.

    c. Aircraft buno.

    d. Defueler number.

    e. Grade of product.

    f. Amount of product actually defueled vice what was scheduled to be removed.

    g. Scheduled amount to have been defueled.

    h. Disposition of product.

    i. Times of the day when the defuel operation was started and completed.

    j. Names of defueler operator and squadron personnel present during the defuel operation.

12.11.1 Personnel Requirements. Each aircraft defueling operation requires a minimum of three people trained and certified in accordance with Chapter 8; the defuel truck operator, a nozzle operator, and a fire watch.

12.11.2 Defueling Procedures. Aircraft defueling tasks are to be performed in the following sequence:

1. Prior to initiating the defuel operation, take samples of the fuel to be defueled from the aircraft's drains and visually inspect them for contaminants. (Qualified squadron personnel under the observation of the driver operator)

2. Determine the status of the fuel; i.e., suspect or nonsuspect (defuel truck operator). The person requesting the defueling operation shall confirm that the fuel is or is not suspect. Fuel is considered suspect if the aircraft has malfunctioned and the fuel is believed to have contributed to the problem or the fuel is thought to be of the wrong type; e.g., AVGAS or automotive gasoline instead of aviation turbine fuel.

3. Determine amount of fuel to be removed from the aircraft (defuel truck operator). Again the squadron personnel requesting the defueling operation shall provide this estimate as part of the official request.

Note

If the aircraft is being defueled due to a faulty (or suspect) fuel quantity gaging system, it will be difficult to estimate amount of fuel in the aircraft.

4. Select defueling equipment to be used; i.e., defueler for suspect product or refueler/defueler for nonsuspect fuel (FMO and station operator). Always check the remaining capacity of the defueler or refueler/defueler to make sure there is adequate room to hold the material being defueled. In addition, remember that sufficient fuel shall be in the defueling tank to maintain a flooded suction above the antivortex splash plate.

5. Position the defueler. (defuel truck operator)

6. Verify that aircraft is spotted properly. (all personnel)

7. Check for possible sources of ignition. (all personnel)

8. Verify that the defueling request chit corresponds to the instructions from the dispatcher. (defuel truck operator)

9. Connect bonding wire from defueler to aircraft. (defuel truck operator)

10. Unload, position, and connect the defuel hose to the aircraft and the defueling stub on the defueler. (plane captain)

11. Commence defueling upon signal from the nozzle operator. (defuel truck operator)

12. Adjust valve downstream of pump to optimize defuel rate.

Note

- Maximum defuel rate is 100 gpm (defuel truck operator). When nearing completion

of the defuel process, very close attention shall be paid to the defuel rate in order to prevent pump cavitation and/or loss of prime.

- Discontinue defueling of an aircraft if pump cavitation is a persistent problem.

13. Upon completion of the defuel operation, secure all equipment and CHECK THE AREA FOR FOD. (all personnel)

12.11.3 Disposition of Nonsuspect Fuel Removed from Aircraft. All USN and USMC aircraft are authorized to use JP-4, JP-8, commercial JET A and JET A-1, as well as JP-5 fuel. Fuel removed from a USN or USMC aircraft will contain mixtures of these fuels and the specific grade of fuel will be impossible to determine without extensive specification testing. USA and USAF aircraft may also contain such mixtures. Therefore, fuel in any properly operating DOD aircraft with turbine engines, which is NOT suspect of being contaminated, can be defueled into a designated refueling vehicle and then used to refuel any aircraft with the user's knowledge and permission. First preference shall be given to using the fuel to load an aircraft in the same squadron as that from which the fuel originated. Second choice shall be to issue the fuel to aircraft having engine fuel controls that automatically compensate for fuel density changes. Aircraft with T56 engines, such as the P-3 and E-2, should be preferentially used since these engines are the most tolerant to such fuel changes. In addition the following rules apply to reissuing defueled fuel:

1. Since fuel removed from any aircraft almost definitely has a flash point below 140 °F, it shall not be used to refuel any aircraft scheduled for immediate sea duty.

2. Any designated defuel/refuelers must pass their fuel through filter/separators and fuel monitors before reaching the aircraft.

3. The FSII content of defueled turbine fuel must be checked using the FSII refractometer prior to refueling S-3 and SH-60 USN aircraft and all USA and USAF and foreign aircraft.

Nonsuspect fuel that has been dyed for the detection of aircraft fuel system leaks can also be used in aircraft provided the above procedures are followed.

Nonsuspect fuel removed from piston-engined aircraft can also be reissued provided:

1. The fuel is a known grade (80/87 or 100/130).

2. It is properly filtered before reissue.

12.11.4 Disposition of Suspect Fuel Removed from Any Aircraft. Fuel removed from any aircraft that has recently experienced engine or airframe fuel system problems possibly related to fuel quality will be segregated by collecting in a designated defueler, a clean storage tank, or any container as "salvage fuel." It will then be sampled and tested to determine if it is in conformance with the deterioration use limits outlined in Appendix B. If the fuel tests within the established limits, it shall be returned to station storage and reissued as the grade and type determined providing adequate filtration and water separation can be accomplished prior to dispensing the fuel.

12.11.5 Handling NATO F-37 (JP-8+100) Fuel. NATO F-37 (JP-8+100) is NATO F-34 (JP-8) which has been additized with a thermal stability improving additive. The thermal stability additive is a dispersant/detergent that:

1. Disarms filter-coalescer elements.

2. Makes free water readings taken with the AEL Free Water Detector (a component of the CCFD) and the Aqua-Glo Free Water Detector unreliable.

Note

Water absorbent filter elements (fuel monitors) will continue to work in the presence of NATO F-37 fuel.

USN/USMC aircraft are not authorized to use NATO F-37. It is possible that USN/USMC aircraft may receive NATO F-37 inadvertently when conducting joint operations requiring refueling from air stations operated by NATO member air forces that utilize NATO F-37.

Note

NATO F-37 is not authorized for use in USAF or other NATO member nations' aerial refueling aircraft.

If aircraft are suspected of having received NATO F-37, and need to be defueled, handle defueling as follows:

WARNING

Do not, under any circumstances, place NATO F-37 into an air station's aviation fuel storage/delivery system.

3. Defuel into refueler/defueler and immediately reissue fuel (as long as no other contamination is suspected). Priority of reissue shall be as follows:

   a. Directly to same or other aircraft

   b. To aviation ground support equipment

   c. To aviation test cells

4. If other contamination is suspected, all fuel defueled from the aircraft shall be treated as hazardous waste and handled accordingly.

5. After reissuing NATO F-37 fuel from refueler/defueler, the following steps shall be taken:

   a. Refill the refueler/defueler with NATO F-44 (JP-5) or NATO F-34 (JP-8).

   b. Note the differential pressure readings for the filter-coalescer elements and fuel monitor elements.

   c. Issue fuel to aircraft following normal operating procedures.

   d. Monitor the differential pressure across the fuel monitor elements.

   e. Change both the filter-coalescer elements and the fuel monitor elements when the differential pressure across the fuel monitor elements reaches 15 psi or the fuel flow degrades significantly.

Notify TYCOMs and AIR-4.4.5 via naval message of any actual/suspected NATO F-37 defueling.

12.11.6 Disposition of Fuel that Does Not Meet the Allowable Deterioration Limits. Fuels that do not meet the allowable deterioration use limits of Appendix B will be handled as described below.

12.11.6.1 Disposition of Aviation Turbine Fuels. Aviation turbine fuels that do not meet the requirements specified herein generally cannot be downgraded for any aircraft use. The only significant exception to this rule is JP-5 which has a reduced flashpoint due to mixing with other turbine fuel. As explained above, this fuel is perfectly acceptable for use in USN and USMC aircraft. It should not, however, be loaded aboard aircraft scheduled for immediate sea duty. Questions concerning the use or disposition of fuel not meeting the deterioration use limits should be referred to the NAVPETOFF, Operations Division, DSN 427-7377; commercial 703-767-7377. In no case will fuel not meeting the deterioration use limits of Appendix B be allowed to mix with existing uncontaminated aircraft fuel.

12.11.6.2 Disposition of Aviation Gasoline. Any questions concerning the use or disposition of fuel not meeting the use limits should be referred to the NAVPETOFF, Operations Division (Code 40), DSN 427-7357; commercial 703-767-7357.

12.12 PRODUCT RECEIPT

12.12.1 Barge or Tanker Receipt of Product. Barge or tanker receipt of product requires advance planning. The FMO will post written orders designating the following:

1. Pier preparation and inspection.
2. Pipelines to be used.
3. Number and sizes of hoses to be connected.
4. Tanks into which cargo is to be received.
5. Pumphouses and pumps to be operated.
6. Number of samples and location where samples are to be taken.
7. Tests required.
8. Communications to be used.

9. Personnel assignments.

10. Preparation of the "Declaration of Inspection" (an Environmental Protection Agency requirement in the 33 CFR administered by the Coast Guard).

The activity instruction shall cover standard operating procedures for:

1. Filling of lines before the barge is docked.

2. Notification to start unloading.

3. Unloading speed.

4. Line patrol and gauge check.

5. Changing tanks.

6. Change in pump operation.

7. Barge stripping procedure and stripping speed.

8. Final inspection of barge tanks.

9. Draining pier lines.

10. Personnel manning level.

11. Personnel training requirements.

12. Special clothing requirements.

13. Fuel sampling and testing requirements.

12.12.2 Pipeline Receipt of Product. Pipeline receipt of product requires essentially the same advance planning as barge receipt and a written order is required. Some pipeline operations, however, are relatively simple and therefore require minimum personnel.

12.12.3 Tank Truck/Tank Car Receipt of Product. Incoming tank trucks and tank cars of aircraft fuel can arrive separately or in groups. All shall be sealed at the source of supply. Unloading of tank trucks requires approximately 1/2 hour and is a 2-man operation. Tank cars are usually left on a siding or in place for the offloading operation. The following procedures apply to both tank truck and tank car receipt:

1. Ensure that seals are intact.

2. Verify that seal number is identical to that on the shipping document.

3. Verify the specification and grade number of the product on the shipping document.

4. Ensure that the fuel level coincides with the marking on the tank and the quantity on the shipping document.

5. Take bottom sample from each compartment, first drawing off water if present.

6. Make visual test of samples.

7. Unload product into a segregated storage tank.

8. Check vehicle's tank interior after delivery.

9. Upon completion of fuel receipt (multiple tank car or truck loads), sample storage tank and perform quality control tests.

12.13 CHANGE OF PRODUCT IN AIRCRAFT REFUELERS

Change of product in mobile refuelers shall be performed in accordance with Figure 12-13. Product that is used to flush tanks and piping shall be treated as contaminated fuel. Samples shall be visually inspected for sediment and water and its specific gravity shall check within 0.5 degrees of the corrected API of the appropriate product in storage.

12.14 CHANGE OF PRODUCT IN STORAGE TANKS

NAVPETOFF shall be contacted concerning instructions for the change of product grade in storage tanks.

TO / FROM	AVGAS LOW GRADE	AVGAS HIGH GRADE	JP-4	JP-5	JP-8
AVGAS LOW GRADE	N.A.	C	C	C	C
AVGAS HIGH GRADE	A	N.A.	C	C	C
JP-4	B	B	N.A.	D	D
JP-5	B	B	A	N.A.	A
JP-8	B	B	A	B	N.A.
MOGAS	B	B	C	C	C
KEROSENE	B	B	B	B	B
DIESEL	B	B	C	C	C

NOTES:

A. Drain, fill with desired product.

B. Drain, flush 300 gallons (600 gallons if total filter/separator capacity is 600 gpm) of desired product, drain, fill with desired product, recirculate, sample, and test. Particular attention shall be given to sumps, pumps, filters, hoses, and other components likely to trap quantities of liquid.

C. Drain, steam clean, and dry. Prior to initiating steam cleaning, fuel shall be removed from all refueling system components; e.g., sumps, pumps, filters hoses, and piping. Filter separator and monitor elements shall be replaced.

D. Drain, gas free, and fill with desired product.

Figure 12-13. Change of Grade Procedures for Aircraft Refuelers

CHAPTER 13

Maintenance of Refueling Facilities at Shore Activities

13.1 GENERAL REQUIREMENTS

This chapter highlights maintenance actions that are critical to the delivery of clean, dry, uncontaminated fuel to aircraft using safe fuel handling equipment and procedures.

In addition to the guidance provided herein, activities shall follow the detailed maintenance programs defined in the NAVFACENGCOM Maintenance Manual Petroleum Fuel Facilities, NAVFAC MO-230. This NAVFAC manual shall be the primary guide to be followed in maintaining aviation fuel facilities.

Each activity shall establish a preventive maintenance (PM) program based on OPNAVINST 4790, NAVFAC MO-230, and this NATOPS Manual. An automated PMS program is available from the TYCOMs, NAVPETOFF, and NAVFACENGCOM.

WARNING

Failure to follow the requirements and procedures contained in this chapter can adversely affect safety of flight for the aircraft being refueled as well as the general safety of fuel handling operations.

13.2 RESPONSIBILITIES

The CO of each Navy and Marine Corps activity is responsible for the fuel aboard his station and auxiliary activities under his command. The entire responsibility, including the maintenance and safe operation of the fuel storage and handling facilities, is delegated to the Supply Officer who, in turn, delegates these fuel duties to the FMO. Maintenance of the aviation fuel facilities and equipment is one of the primary responsibilities of the FMO and his Fuel Division.

The FMO is responsible for many maintenance actions since they fall within the capabilities of his assigned personnel. Even when outside resources and manpower are needed for maintenance actions, it is the FMOs responsibility to initiate such actions. The Public Works Officer (PWO) must provide most of this assistance.

One of the most important duties of the FMO at shore stations is to initiate facility improvements and upgrades. NAVAIR, NAVFAC, NAVPETOFF, and TYCOMs are available to provide assistance to any station with upgrade and modernization programs. Long term, programmed maintenance shall be coordinated with the public works forces and other activities, particularly NAVFAC Field Division personnel, the Coast Guard, OSHA and EPA. It should be noted that even under ideal conditions, MILCON projects take approximately four years from day of submission to the day ground-breaking takes place. The FMO is responsible for keeping all maintenance, repair, and inspection reports on file for fuel servicing equipment and facilities under his/her jurisdiction. Whenever equipment facilities are reassigned, the records shall be forwarded to the new owner.

13.3 PREVENTIVE MAINTENANCE PROGRAM (INSPECTIONS)

Although a well-executed and documented PM program will substitute for many of the routine inspections, a formal inspection program is necessary. The implementation of an inspection program is the responsibility of the FMO and shall include:

1. Inspections of equipment and facilities prior to use.

2. Inspections prior to major operations.

3. Seasonal or special inspections.

4. Routine inspections and checklists.

13.3.1 Inspections Prior to Use. New construction, out-of-service facilities, broken down equipment, and facilities and equipment that have been provided with corrective or programmed maintenance, shall be inspected prior to acceptance or reactivation. Special attention should be given to rated capacities of hardware, pipeline sizing, drainage, accessibility, emergency controls, safety, and fire prevention features.

Inspections shall be conducted prior to starting major operations; e.g., receipt of product to or from ships or between large storage tanks, or high-tempo training exercises. Inspections should cover equipment performance, pipeline integrity, valve positioning, tank arrangement, and personnel manning.

13.3.2 Seasonal or Special Inspections. In climates where freezing weather is encountered, winterization inspections should be made in the early autumn. Extensive inspections for damage or malfunctioning should be conducted following any storm, flood, fire, earthquake, lightning strike, suspected act of sabotage, or vandalism. Special inspections are called for when abnormal variations of performance, flow rates, pressures, or capacities are experienced or noted by operators. Special inspections, performed by personnel from other departments, may be conducted upon request, or as required, on electrical equipment, communications equipment, buildings, security fences, roadways, and fire prevention equipment.

13.3.3 Aircraft Refueling Equipment Checklists. Each activity shall use daily, weekly, monthly, and periodic checklists similar to those contained in Figures 13-1 through 13-4. Locally developed checklists that are specific to individual installations or systems may be substituted.

13.3.3.1 Daily Checklist. The daily checklist shall be completed on all aircraft fuel delivery equipment that is in continuous use, once in every 24-hour period on a not-to-interfere-with-aircraft-servicing basis.

WARNING

Equipment that fails to meet established requirements shall be removed from service until corrective action has been completed.

The following detailed discussions pertain to the serially numbered items in Figure 13-1, Daily Checklist:

1. Fire extinguishers. Report discrepancies immediately and do not use the equipment until certified.

2. Inspect nozzle for damage; check nose seal for cracks or nicks, outer shell for tightness to top connection, safety wire on lock bolt, handles for tightness, and flow control handle for excessive wear, cracks or breaks.

3. Hook up nozzle to bottom-loading adapter or recirculation fitting and inspect the entire nozzle assembly for broken, cracked parts, or evidence of leaks.

   a. Aircraft refueling nozzles shall be stored with their dust covers in place.

   b. On mobile refuelers, nozzles shall be stowed in a manner that will prevent them from falling or dragging from the vehicle in motion. At no time will nozzles be allowed to extend beyond the extremities of the unit while in transit. Nozzle storage shall provide protection from the environment and in particular, the nozzle face seal and poppet areas to prevent their damage and contamination. Special attention shall be placed on the positioning of nozzles in storage to ensure that accumulation of dirt and water is minimized.

Note

When nozzles are allowed to hang inverted, exposed to the environment, water and dirt may build up in bearing collar and nose seal areas.

4. Inspect the entire length of the hose thoroughly. Special emphasis should be placed on the area close to the nozzle and near the connection at the opposite end where hose should be pressed and tested for soft spots around its entire circumference. Be alert for blisters and wet spots. Any exposed hose reinforcement material is cause for hose replacement because exposed fabric provides a source for water to enter, migrate, and ultimately rot the fabric. Inspect the area around hose end couplings for slippage (evidenced by misalignment of hose and couplings and/or scored or exposed areas). Painting a strip across the coupling and hose will aid in this inspection since the unpainted part of the hose that was underneath the coupling will become visible if the coupling slips any significant amount. A hose assembly that has been subjected to abuse, such as severe end pull, flattening or crusting by vehicle, sharp bending or kinking, shall be removed from service. All hoses, whether in service or in reserve, shall be stored as follows:

    a. Store all hoses in a manner that prevents twists, sharp bends, or kinks.

    b. Protect hoses, not used daily, from the sun in order to reduce ultraviolet deterioration.

    c. Cover both ends to prevent damage to threads and the introduction of contaminants.

    d. Store hoses off the ground to prevent the collection of water and dirt. Hoses being removed from service for an extended period of time shall be drained of all fuel and the ends capped prior to being placed in storage. When returning a stored hose to aircraft fuel service, it shall be flushed thoroughly. Fuel samples taken at the nozzle shall meet the quality standards of Chapter 9 or the hose will NOT be used for aircraft refueling.

5. Bonding cables shall be in place and in good condition, clean and with serviceable plugs and clips securely attached. If grounding cables are used a similar check should be made.

6. Carefully inspect tanks, piping, valves, pumps, meters, and couplings for leaks. If any leaks are found, record the location and immediately "down" the equipment. It shall not be used until repaired.

7. Check emergency valve controls for condition and ease of operation. If air-operated, build up system pressure and check operation of the controls. Keep emergency valve closed at all times except when delivering fuel or circulating product.

8. Exterior surfaces should be wiped clean of oil, grease, and fuel. Ensure that cabinets, troughs, cab, and any enclosure is free of an accumulation of fuel, dirt, cleaning material, and unnecessary items. Check fenders and mudguards to ensure adequate protection against throwing of mud and dirt on fueling equipment and rear of unit.

9. Check the fluid levels of the battery, radiator, gas, and engine oil.

10. Ensure that lights are operable, all electrical wiring outside of cab is enclosed in tubing, and rear view mirrors are serviceable.

11. With equipment in level position, drain product from the manual low point drain of the tank into a clean container. If water is found, empty sample into salvage container and repeat the process until a clean, water-free sample is obtained.

    a. Open the filter/separator manual drain valve and drain off all water. After all water has been drained, draw approximately one pint of fuel into a clean container and visually inspect for water. Repeat as necessary until only clean, bright fuel is obtained. A low point drain sample should also be taken from the fuel monitor housing, if separate from the filter/separator housing, and inspected for water and particulates. Again, repeat until only clean, bright fuel is obtained.

12. Carefully inspect the exhaust pipe and muffler(s) system(s), including any auxiliary engine system, for leaks, cracks, noise and proper placement. Ensure that clean-out port in spark arrestor is covered. Flex piping is not authorized.

13. Check the emergency brakes to ensure there is plenty of throw on the emergency brake handle and that brakes hold.

14. Drain air tanks of moisture and check for fuel contamination. Malfunctioning air-operated valves that control fuel flow and check valves have been cited as causes for fuel entering brake air systems. The smell of fuel or fuel droplets in the air being bled off is cause for immediately "downing" the equipment until the problem is resolved. The most common source of fuel or fuel vapors in the air system is the rupture or cracking of a diaphragm in the fuel flow control valve. In addition, corrosion resulting from moisture in the air system can cause one-way check valves to remain open thus allowing fuel into the system.

15. Engage the pump and pressurize the system. Check entire system for leaks. The maximum allowable circulation time for refuelers, less than one half full, is three minutes. Hose inspections in item number 4 above should be conducted during circulation. Check to see if fuel is leaking from the vent port on the hose end pressure regulator. If fuel is leaking from this port, remove the hose end pressure regulator from service and repair it.

WARNING

- Equipment that fails to meet the established requirements shall be removed from service until corrective action has been completed.

- The vent port on the hose end regulator shall never be plugged since it is critical to proper operation.

16. Place the nozzle's flow control handle to the fully opened and locked position and circulate fuel. Circulation is to be performed through either the bottom loader or recirculation receptacle on the same or another unit. (An adapter is necessary for over-wing nozzles.) On refueling trucks, circulation is to be performed at standard rpm settings where flow rates can be measured and differential pressure readings are meaningful. Circulation of trucks must be limited to a period of 10 minutes, each followed by a 1-minute rest period to allow electrostatic charges to dissipate. All equipment must be circulated for a time period that is sufficient to flush out all piping downstream of the fuel monitor elements.

17. Check operation of the pump. Listen for unusual sounds and feel for overheating and/or abnormal vibrations.

18. Remove a fuel sample from the quick disconnect sampling port on the nozzle and check its cleanliness, brightness, and color. The sample should be drawn as rapidly as possible without spilling fuel. Swirl the fuel to form a vortex and check for sediment on the bottom. Check brightness or clarity under good light conditions. The sample should be free of any emulsion, cloud, or haze. Record the actual physical condition of the fuel on the checklist.

19. With system recirculating, observe the pressure drop across the filter/separator and the monitor. The daily pressure drops across each filter/separator and monitor shall be recorded in a special log similar to the one shown in Figure 13-5. The system shall be operating at standard flow conditions (e.g., during recirculation or flushing). Enter the differential pressure calculation on the checksheet and the pressure differential log for the equipment.

WARNING

Differential pressure readings shall only be made when the system is operating at standard conditions since the accuracy of the differential readings is directly dependent on the system's overall flow and pressure conditions. Use of nonstandard, variable operating conditions makes the results meaningless and will prevent the identification of filter or monitor element failures.

13.3.3.2 The Weekly Checklist. In order to provide continuity to the checks of the various items, the Weekly Checklist (Figure 13-2) shall be performed by a senior operator or fuel shop personnel. The weekly inspection shall be performed on all equipment being

returned to service, following any DOWN time that exceeds 72 hours.

The following discussion pertains to items shown in Figure 13-2. Weekly requirements are:

1. Complete items 1 through 17 on the daily checklist.

2. Take samples during recirculation and test, using CCFD and FWD. This sampling effort may be conducted a few days prior to the time the remainder of checklist inspections are performed; however, the results from the CCFD and FWD shall be entered in the appropriate laboratory log.

3. All underwing and overwing nozzle screens shall be cleaned and inspected. This may require removal and replacement of the complete nozzle assembly. If screens are removed and replaced, a method of identifying the refueling unit from which each screen was taken is important.

   a. Screens should be cleaned with compressed air to extend their life. Analyze the contents of nozzle strainers over a collection pad. Rubber particles in screens are often the earliest evidence of hose deterioration.

   b. When reinstalling nozzle screens, it is necessary to ensure there is no movement of the nozzle strainer that may allow fuel to bypass around the outside of the strainer, allowing possible contamination to enter aircraft fuel tanks.

   c. Detailed instructions, expanded illustrations, and troubleshooting tables of the nozzles and couplings in use shall be available and posted in the workshop.

4. Inspect tires, brakes, steering, lights, and fifth wheel (use of a transportation inspector may be beneficial for this).

   a. Brake linings and/or pads shall be checked by normal application of the brake while observing the pedal travel. (The measurement of actual stopping distances, following a maximum application of brakes, is considered too severe and hazardous a test for refuelers.)

   b. Test the emergency brake under drive conditions. It is important to ensure against "creep" during a fueling operation.

   c. Ensure all electrical wiring outside of the cab is encased in tubing that terminates in securely mounted vapor-tight fixtures or junction boxes with compression fittings.

5. Measure and record pressure drop across the filter/separator and across the fuel monitor using a sensitive, handheld pressure gauge accurate to ±1 psi with graduations in 1 psi (or smaller) units. This test shall be conducted in place of item 19 in the daily checklist. The handheld pressure gauge is used to double check the pressure gauges on the equipment. The system shall be operating at standard flow conditions (e.g., during recirculation or flushing). Enter the differential pressure calculation on the checklist and the pressure differential log (Figure 13-5) for the equipment.

WARNING

It is essential that differential pressure readings be made only when the system is operating at standard conditions. The accuracy of the differential readings is directly dependent on the system's overall flow and pressure conditions. Use of non-standard, variable operating conditions makes the results meaningless and will prevent the identification of filter or monitor element failures.

Refueling equipment configured with combination filter/separator and fuel monitors usually have one pressure gauge and a four-position selector marked IN, CENTER, OUT and OFF. With this configuration, the CENTER position is OUT for the filter/separator and IN for the fuel monitor. Readings should be taken by a skilled operator under predetermined standard conditions.

Note

If standard conditions do not reflect the rated capacity of the filter-separator or monitors, the pressure differentials will have to be calculated as follows:

True differential pressure =
(Rated flow/Standard flow) measured differential pressure.

Example: A 5 psi differential pressure is obtained when operating a 600 gpm system at 300 gpm

True differential pressure =
(600/300) 5 psi = 10 psi

13.3.3.3 Monthly Checklist. The Monthly Checklist, Figure 13-3, requires special equipment and moving of mobile equipment to a location other than the operating area. The following discussion pertains to items in Figure 13-3. Monthly requirements are:

1. Complete Daily and Weekly Checklists.

2. Check continuity of grounding cables, bonding cables, and reels if they are stowed in that manner. Continuity shall be measured with cable in the stowed, fully extended, and intermediate condition. Check the continuity of the grounding cable on each overwing refueling nozzle.

3. Inspect and clean all line strainers, including meter strainers, when installed. These screens protect expensive downstream components of a fueling system. The inspection and cleaning interval for line strainers may be lengthened to quarterly, if access is difficult; however, under no circumstances shall the time interval exceed three months since the existence of foreign matter in line strainers could forewarn of problems before complete breakdown.

4. Test the anti-driveaway device installed on all refuelers.

5. Perform engine spark check at night. Its purpose is to locate any electrical traffic over the outside surfaces of wiring, spark plugs, etc. Any auxiliary engines should be included in the test. Any observed arcing, however slight, is sufficient cause to remove the equipment from service.

6. Test maximum flow rate. The maximum flow rate for fueling aircraft is 600 gpm and the maximum allowable pressure at the skin of the aircraft is 55 psi. Flow rates may vary depending on the design and installation of the equipment. Historical records of the pressures and flow rates shall be maintained to aid in identifying long-term mechanical wear (i.e., pump wear rings, diaphragm ruptures).

CAUTION

If pressure tests indicate nozzle pressure test exceeds 55 psi or the flow rate exceeds 600 gpm, the equipment shall be removed from service.

7. Test of the primary pressure control system shall be performed with the hose end regulator blocked out or removed from the system. The following general procedure describes how to test the performance of the basic or primary pressure control system on all refueling equipment:

   a. Install a pressure gauge (0 to 100 psi single line increments) into the nozzle sampling connection.

   b. Either remove the hose end regulator from the system by exchanging the nozzle assembly for one without a pressure regulator or attach a “block-out” device to the hose end pressure regulator to prevent it from operating (i.e., controlling nozzle pressure). The block-out device equalizes pressure on both the inside and outside of the hose end pressure regulator which prevents it from operating. Block-out devices for hose end pressure regulators, along with instructions for their use, are available from the regulator manufacturers.

CAUTION

At no time shall a block-out device remain installed during aircraft refueling operations.

   c. Set up system for circulation of fuel.

d. With system operating at normal flow rate, slowly close the nozzle's flow control handle until the flow of fuel is completely stopped while watching the pressure gauge in the nozzle. Keep truck or fixed equipment (pump) operating. This action simulates the aircraft shutting down the fuel flow. If pressure climbs above 50 psi, the primary pressure control system is either incorrectly set and must be adjusted, or the system is malfunctioning and must be repaired.

Note

- In addition to primary pressure control, the refueling control valve also provides a surge-pressure quick shutdown feature. In the event of a quick downstream flow shut off, either from an aircraft high-level shutoff or from the quick closure of the HECV, the surge shutoff pilot valve will quickly close the fueling control valve (whether the deadman is released or not). This feature protects the fuel hardware between the fueling control valve and the nozzle from high pressure spikes. In order to prevent fighting between the valves, pilots must be adjusted in sequence in DESCENDING ORDER of pressure: 1) HECV — 55 psi (fixed-spring); 2) Surge shutdown — 50 psi; and 3) Primary pressure control — 45 psi.

- When adjusting the surge and primary pressure controls, block out the HECV. For HECVs with lower pressure settings, the surge and primary pressure control shall be adjusted downward accordingly, with approximately 5-psi spacing.

e. After verifying the integrity of the primary pressure control system, remove the block-out device and open and close the nozzle a minimum of three times under flow conditions. Fuel that has been trapped in the cavity during the test will be pumped out through the vent port. Replace hose end pressure regulator vent screen in appropriate port if it was necessary to remove it.

CAUTION

If the pressure exceeds 55 psi, remove the equipment from service until both the primary pressure control system and hose end pressure regulator are adjusted and/or repaired.

8. Check refueling adapters (receptacles) using the go/no-go gauge (NSN 1RW-5220-01-301-9247) or alternate go/no-go gauge (NSN 5220-01-343-1688).

WARNING

A worn or broken adapter can defeat the safety interlocks of the refueling nozzle, permitting the poppet valve to open and fuel to spray or spill.

9. Ensure that fuel handling equipment is marked in accordance with NAVFAC P-300 or MIL-STD-161.

13.3.3.4 The Periodic Inspection and Annual Record. The Periodic Inspection and Annual Record, Figure 13-4, provides an important historical record for each piece of refueling equipment. The frequencies are absolute minimums. Local conditions may require more frequent inspections. The N.R. in seasonal columns translates to needs repair and does not mean not required. The inspection items contained in this checklist are self-explanatory.

WARNING

Tank interior and manhole cover inspection in Figure 13-4 is the only time, other than the performance of tank maintenance and cleaning, when manhole covers are to be opened. Manhole covers should be semi-permanently secured with padlocks or by other means. Opening the manhole cover presents several dangers including the possible introduction of ignition sources into the flammable vapor space of the tank as well as contaminants into the fuel.

13.3.3.4.1 Hose End Pressure Regulators. Hose end pressure regulators shall be tested for performance and integrity annually. Since this test requires readjustment of the primary pressure control of a refueling system to a much higher than normal setting, it is recommended that each activity:

1. Select one refueling system for conducting this test on all its hose end regulators.

2. Shall not refuel any aircraft with the selected system until the primary pressure regulating system has been reset to normal conditions.

Test hose end pressure regulators as follows:

a. Adjust the primary pressure control of the selected refueling system to a value of 73 to 76 psi.

WARNING

The primary pressure control shall be reset to 50 psi at the refueling nozzle before the system is used to refuel aircraft. Overpressurization of an aircraft's fuel system could result in the rupture of a tank, fuel spill, and fire.

b. The HEPR regulates outlet pressure to a nominal 55 ±5 psig. Since it does so by restricting flow, it may regulate closer to 60 psig at low flow rates while allowing 50 to 55 psi at typical fueling rates. Insert a pressure gauge (0 to 100 psi) into the nozzle gauge port. The outlet pressure shall not exceed 60 psi at flowrates between 0.50 and 2 gpm.

CAUTION

If the nozzle pressure exceeds 60 psi at flow rates above 0.50 gpm, remove regulator from service.

c. Under flow conditions, slowly close the downstream valve in approximately 3 seconds. Upon closure, observe gauge for approximately 10 seconds. If pressure increases, remove unit and replace seal. It is not unusual for the gauge to read between 55 and 80 psi. This is because the gauge has trapped some of surge generated by closing the valve.

CAUTION

The primary pressure control system shall be readjusted to 50 psi before refueling any aircraft.

13.3.3.4.2 Hydrostatic Testing of Refueling Hose. Hydrostatic testing of refueling hose shall be conducted annually or whenever the integrity of the hose is suspect. Hydrostatic testing shall be in accordance with ASTM D380 (paragraphs 14 to 17) at a pressure of 120 psi.

13.3.4 Filter/Separator — Fuel Monitor Pressure Log and Graph. Filter/separators and fuel monitors are critical components in aviation fuel handling systems and their performance shall be carefully monitored. They provide the primary means of assuring that only clean, dry fuel is loaded into aircraft. In addition to the daily, weekly and monthly inspections and tests for particulates and water performed on fuel samples taken downstream of the equipment (such as at the refueling nozzle), it is essential that the pressure drop across each housing be accurately determined so that the integrity of the elements can be verified. Ruptures or breaks are identified by a significant drop in the differential pressure. Over time the differential pressure across the filter elements will increase as more and more dirt and/or water is trapped. All activities shall maintain a log similar to Figure 13-5 for each filter or monitor vessel. In addition, it is mandatory that activities plot the weekly readings (which should be more accurate than the daily readings since a sensitive hand-held pressure gauge is used and more care taken to ensure standard pressure and flow conditions are achieved) on a graph such as shown in Figure 13-6. This will provide an instant picture of what is happening and has been shown to be helpful in determining a rupture or indicating that the elements are no longer useful.

Note

If standard conditions do not reflect the rated capacity of the filter-separator or monitors, the true pressure differentials will have to be calculated as discussed in paragraph 13.3.3.2, step 5.

13.3.5 Filter/Separator — Fuel Monitor Element Change. Filter and monitor elements in refueling equipment or at truck fill stands shall be changed every three years unless an earlier change is forced by one of the following:

1. The pressure drop across either the filter or monitor elements reaches 20 psi.

Note

Differential pressure measurement must be made at rated capacity or calculated as discussed in paragraph 13.3.3.2, step 5.

2. In a three stage filter vessel (coalescer, separator, and monitor in one vessel), if the combined pressure drop across the filter and monitor elements is above 25-psi and the flow rate drops below an acceptable level.

3. The graph of differential pressures turns downward, indicating a rupture.

Note

A gradual downward trend in pressure drop is occasionally noticed with types of monitor elements now in use. This is not sufficient reason to change the elements. The cause of this phenomenon is the slow drying out of elements that have absorbed significant amounts of water. The drying out and subsequent reduction in pressure differential will continue as long as the elements are exposed to very dry fuel.

4. The graph fails to increase after an extended period indicating either ruptured elements or improper installation.

5. The complete shutdown of fuel flow and/or a very rapid increase in pressure differential across the monitor elements. This usually indicates a failure of the filter/separators. If this occurs, both the filter separator and monitor elements must be changed.

Note

If the pressure drop across the monitor elements is close to the 20-psi limit while the filter/separator pressure drop remains low, it may be a sign that the filter/separator is no longer coalescing water. In such a situation it is advisable to change both the filter and monitor elements.

During filter changes, the permanent second stage water separator elements should be tested for their ability to repel water. If the separator element does not repel or cause the water to bead, it should be washed with warm water, thoroughly rinsed, and tested again.

Whenever filter elements are changed, the date of the filter change shall be stencilled on the filter vessel.

All discarded filter elements shall be disposed of in accordance with local hazardous material instructions.

No filter/separator or monitor vessel, regardless of vintage, should be discarded until all possible uses for it have been explored. Empty vessels can be modified for use as relaxation chambers. Many older type filters, not qualified for refuelers or fill stands, may serve well as receipt or circulation filters because of their greater carrying capacities for solids.

13.3.6 Storage and Distribution Facilities Checklist. The Figure 13-7 checklist is presented as a guide to illustrate a method for recording operator and preventative maintenance for the storage, distribution systems, and fuel facilities. This checklist does not provide full coverage and shall be expanded locally to include all fuel related equipment. The Figure 13-7 checklist, when tailored to the activity fuel facilities, will serve as a basis for ordering corrective maintenance.

13.3.7 Calibration. Calibration is required for deadweight testers, master meters, and meters/gauges used at the point-of-sale. Personnel who have been certified by an official Navy calibration laboratory (or other certifying agency) shall perform these calibrations. Non-certified personnel may calibrate meters/gauges that are not used at the point-of-sale by means of a master meter or deadweight tester. Non-certified personnel performing calibrations on non-point-of-sale meters/gauges should be familiar with proper calibration procedures.

13.4 RECORDS AND REPORTS

Observation of abnormal operating conditions is vital to a good preventative maintenance program. The detection of small operating faults and their subsequent

minor correction or repair can often avert the development of major problems requiring extensive repairs. Such conditions must be promptly reported to the proper authorities in order to achieve the necessary repairs or corrections. These deficiency reports must be in written form.

Maintenance records. A facility shall maintain records in sufficient detail to provide the following:

1. Identify each major structure, equipment item, group of items, or system.

2. Current maintenance status, including unfunded deficiencies and uncompleted job orders.

3. Past maintenance history, including description and cost of major repairs or replacements.

4. Recommendations for future programmed repairs or replacements, including estimates of funds or manpower requirements.

Whenever major problems are noted with refueling facilities or equipment that could possibly be a result of a design or manufacturing flaw, forward details to the appropriate cognizant Systems Command Headquarters for investigation and resolution.

Report problems with installed facilities to:

Naval Facilities Engineering Service Center
Office of the Chief Engineer, Code 00CE3
901 M Street, SE Bldg. 218
Washington, DC 20374-5018

Telephone: 202-433-8764 or DSN 288-8764
Telefax: 202-433-8777

Report problems with refueling vehicles, nozzles, filter and monitor elements, and fuel quality monitoring equipment to:

Naval Air Systems Command
AIR-4.4.5 (Fuels), Bldg. 2360
22229 Elmer Road, Unit 4
NAS Patuxent River
Patuxent River, MD 20670

Telephone: 301-757-3410 or DSN 757-3410
Telefax: 301-757-3614

13.4.1 Record Retention. Records shall be retained as specified in the following schedule:

1. Monthly maintenance reports/logs — 2 years

2. Completed daily checklists — 1 month

3. Completed weekly/monthly checklists — 6 months.

Vehicle or Hydrant #		Meter Reading		Product	Date_____ Time_____
#	Item (See paragraph 13.3.3.1)	OK	Adjust	Repair	REMARKS
1	Fire extinguishers (in place, filed, operable, current inspection tag)				
2	Nozzle stowage dust cover and bonding cable on gravity nozzle				
3	Hook up nozzle to bottom loading adapter or recirculation fitting, and check entire nozzle assembly				
4	Hose: Check entire length for cuts, cracks abrasions, and fuel saturation				
5	Static bonding cable, plug/clip				
6	Leaks (tank, piping, valves, pumps, etc.)				
7	Emergency valves (operation of controls)				
8	Cleanliness				
9	No FOD in tires				
10	Battery, radiator, gas, and oil levels				
11	Lights, reflectors, rearview mirrors				
12	Drain all low point drains (tank, filter/ separator, monitor, relaxation chamber)				
13	Exhaust pipe and spark arresting muffler (leaks, cracks, or noise)				
14	Emergency brakes				
15	Drain water from air tanks				
16	Fill hose with full pump pressure and check entire system for leaks				
17	Open nozzle valve, check nose seal for leaks, circulate fuel, and check flow rate				
18	Pump (noise, overheating, vibration)				
19	Draw nozzle sample, visually inspect for water, solids and color and record results	Water_____ Sediment_____ Color_____			
20	Take samples during recirculation and test using CFD and FWD	Particulates by CFD_____ Water by FWD_____			
21	Record pressure differential reading from filter/separator and monitor	Pump Pressure_____ Filter Pressure Diff._____ Pump RPM_____ Monitor Pressure Diff._____ Flow Rate_____			
COMMENTS:					
INSPECTOR'S SIGNATURE		SUPERVISOR'S SIGNATURE			

Figure 13-1. Daily Aircraft Refueling Equipment Checklist

Vehicle or Hydrant #		Meter Reading		Product	Date _____ Time _____
#	Item (See paragraph 13.3.3.2)	OK	Adjust	Repair	REMARKS
1	Complete Items 1–21 on the Daily Checklist				
2	Inspect and clean refueling nozzles (SPR and gravity)	Description of Screen Contents: SPR _____ Gravity _____			
3	Inspect tires, brakes, horn, windshield wipers, steering, trailer coupling and electrical wiring				
4	Record pressure differential reading from filter/separator and monitor	Pump Pressure _____ Filter Pressure Diff. _____ Pump RPM _____ Monitor Pressure Diff. _____ Flow Rate _____			
COMMENTS:					
INSPECTOR'S SIGNATURE		SUPERVISOR'S SIGNATURE			

Figure 13-2. Weekly Aircraft Refueling Equipment Checklist

Vehicle or Hydrant #		Meter Reading		Product	Date_____Time_____
#	Item (See paragraph 13.3.3.3)	OK	Adjust	Repair	REMARKS
1	Complete daily and weekly checklists				
2	Check electrical resistance of all bonding and ground cables and reels				
3	Inspect and clean all line strainers				
4	Test anti-drive away device				
5	Perform engine spark test				
6	Test maximum flow rate				
7	Test primary pressure control				
8	Check refueling adapters				
9	Check equipment markings				
COMMENTS:					
INSPECTOR'S SIGNATURE		SUPERVISOR'S SIGNATURE			

Figure 13-3. Monthly Aircraft Refueling Equipment Checklist

PERIODIC AND ANNUAL RECORD FOR _____													
	Spring			Summer			Autumn			Winter			
Equip. type & #	OK	Adj	NR	OK	Adj	NR	OK	Adj	NR	OK	Adj	NR	Remarks
Brake linings/pads													
Headlight beams													
Wheel inspection													
Suspension inspection													
Calibrate pumps & meters													
Calibrate pressure gauges													
Body Inspection													
Paint and decals													
Record Dates Performed													
	Spring			Summer			Autumn			Winter			
Oil change/lubricate													
Tank interior and manhole covers													
Winterize													
Filter element change													
Monitor element change													
Product change & flush													
Brake linings replaced													
Cabin carbon monoxide check													
Test hose end pressure regulator													
Hydrostatic test of refueling hose													
Others (list)													
Inspector's Signature													
Supervisor's Signature													

Figure 13-4. Periodic and Annual Report

FILTER/SEPARATOR OR MONITOR PRESSURE DROP LOG					
Vessel Number:				**Vessel Type:** • Filter/Separator • Monitor	
Vessel Location:				**Vessel's Rated Flow (gpm):**	
Date	**Pressure (psi)**			**Measured Flow Rate (gpm)**	**Calculated Differential Pressure (psi)**
	Inlet	**Outlet**	**Differential**		

Figure 13-5. Filter/Separator and Fuel Monitor Pressure Drop Log

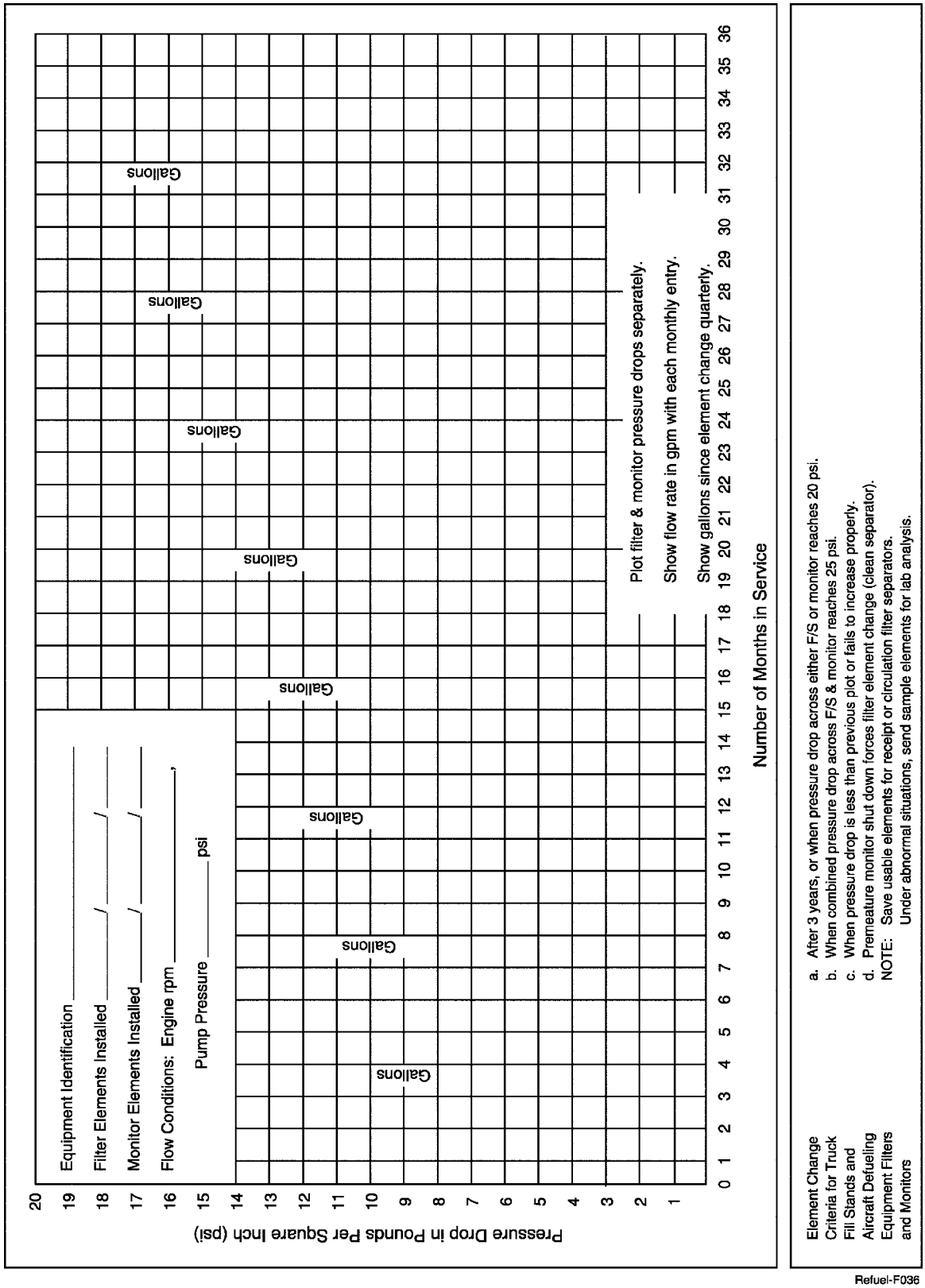


Figure 13-6. Filter/Separator and Fuel Monitor Pressure Drop Graph

DAILY STORAGE/DISTRIBUTION FACILITIES CHECKLIST			
Facility		**Product**	**Date/Time**
Line	**Item**	**Initial**	**Remarks**
1	Buildings: Condition/Serviceability		
2	Grounds: Vegetation/Hazards		
3	Firefighting Equipment (in place)		
4	Security Lighting/Fencing/Gates		
5	Berm Areas: Vegetation Control Drains Free, Closed and Locked		
6	Tanks: Last Inspected/Cleaned (date)		
7	Piping and Joints		
8	System Markings: MIL-STD-161F		
9	Valves: Operation/Lubrication		
10	Pumps: Noise, Vibration, Overheating		
11	Filters: Drain, DP REading, Chg Date		
12	Meters and Gauges: Calibration Dates		
13	Receipt and Issue Hoses/Issue Point Pantographs: Storage and Protection		
14	Overfill Protection/Deadman Controls		
15	Relaxation Chambers (as applicable)		
16	Grounds; Condition/Continuity Checked		
17	Pits: Covers, Clean and Dry		
18	Emergency Showers and Eye Washes		
19	Electric: Switches/Controls/Lights		
20	Spill Containment Systems		
21	Pier Facilities (as applicable)		
COMMENTS: (Report all leaks, hazards and damage in the appropriate space.)			
Inspector:		Supervisor:	

Figure 13-7. Daily Storage and Distribution Facilities Checklist

CHAPTER 14

Organization and Training for Tactical Fuel Operations

14.1 ORGANIZATION

The effectiveness of any complex operation is dependent or a well structured organization with qualified and knowledgeable supervision. The cost of fuel, equipment, the hazards associated with fuel operations and the essential part aircraft refueling plays in flight operations are a few of the critical factors that shall be considered in the development of a Fuels Branch's Table of Organization (T/O).

Navy Advanced Base Functional Component Fueling System operators shall comply with the standard shore activities' requirements for organization and training contained in Chapter 8 of this NATOPS Manual.

Marine Corps units are urged to continue their T/O review process to ensure that personnel in adequate quantities and with sufficient grade structure, training, and seniority are available to responsibly operate tactical fuel systems and auxiliary equipment in response to maximum projected operational demands. Forward Operating Base (FOB) support methodologies, relative to type and numbers of aircraft to be supported, must also be considered.

The viable T/O should provide for enough personnel to handle increased workloads on short notice. Lengthening working shifts (recommended 10 hours) and non-standard duty sections, including stand-by duty section assignments, should be last-resort measures.

The commodity managers/functional heads (Fuels Officer [FO] and Fuels Chief [FC]) of integrated fuel operations shall:

1. Possess broad fuel background and experience (e.g., formal training and experience in the technical area of fuel operations and handling)
2. Be full-time primary assignments
3. Carry delegated authority commensurate with responsibility.

Note

Reference to the FO and FC in this NATOPS manual parallel references to the FMO and AFMO in MIL-HDBK-844(AS), respectively.

14.1.1 Responsibilities. The unit commander is responsible for receipt, storage, accountability, issue, quality assurance, and environmental impact of petroleum products within FOBs. The preventive and corrective maintenance of all tactical fuel handling, storage, and delivery systems assigned to the unit are integral parts of this responsibility.

The FO discharges the unit commander's fuel responsibilities through the planning, directing, training, and supervision of a completely integrated fuel operation. This mandate shall be carried out in accordance with current directives.

Aircraft custodians are responsible for training personnel who are qualified nozzle operators and aircraft directors for aircraft refuelings and defuelings. The nozzle operator shall assist the refueler operator in handling the hose and nozzle prior to, and after the servicing of aircraft in order to minimize hose wear and nozzle damage due to dragging.

The Airfield Operations Officer is responsible for establishing priorities for aircraft fuel delivery services.

14.1.2 Duties. Refer to the MOS Manual and associated Individual Training Standards for a detailed discussion of the various specific duties of the FO, FC, and other personnel involved in fuel handling operations.

14.2 TRAINING REQUIREMENTS

14.2.1 General Training Requirements. It is essential to the safety of fuel handling operations that personnel be properly trained. Only those personnel qualified in accordance with the current MOS Manual for MOS 1390, 1391, 3534 shall be involved in aircraft refueling operations from source to nozzle. These individuals will also require sustainment training in accordance with the Marine Corps Individual Training Standards System (ITSS) and this NATOPS Manual.

Additionally, personnel involved with aircraft refueling shall be trained via an informal course in which the applicable contents of this manual, MIL-HDBK-844(AS) and NAVSUP P-558 are taught. The course shall be developed to emphasize safety and procedural requirements contained in these manuals and how they apply to local situations. Personnel shall be required to demonstrate their acquired knowledge relative to their grade and/or position.

14.2.2 Refueling Vehicle Operator Certification. Mobile Refueler Operators (MOS 3534) shall carry a current U.S. Government Motor Vehicle Operator's Identification Card and comply with the requirements delineated in MCO P11240.7, the Marine Corps' Licensing Manual(s), MOS Manual, and Individual Training Standards System.

14.2.3 Nozzle Operators' Training and Certification. Nozzle operators shall be thoroughly trained and certified in accordance with the applicable directives for the type, model, and series of aircraft being refueled. This training shall result in the nozzle operator possessing a thorough working knowledge of the aircraft's fuel system including the following specific items:

1. Aircraft's ground refueling panel
2. Precheck system
3. Location and operation of any switches that control the flow of fuel into the various tanks of the aircraft
4. Location of the aircraft's fuel system vents
5. Mechanism(s) by which the pressures within aircraft tanks must be monitored (to prevent over-pressurization)
6. Mechanism(s) by which the tank loading status (e.g., full, partial, no load) can be monitored.

CHAPTER 15

Quality Surveillance of Aviation Fuels for Tactical Units

15.1 GENERAL REQUIREMENTS

The major objective of fuel handling personnel is to deliver clean, dry, and correct fuel to aircraft. The fuel systems of modern aircraft are complex and will not function properly if fuel is contaminated with dirt, water, or other foreign matter. In addition, aircraft engine failure or poor performance may also be caused by incorrect fuel or by contamination through commingling. Refer to MIL-HDBK-844(AS) for a detailed discussion of the various types of fuel contaminants, their effects on the using equipment, and their possible sources.

The quality surveillance of aviation fuels is a continuous process. Every action such as transferring product from one tank to another or short-term storage can introduce contaminants into the fuel. Sources of contamination must be recognized and eliminated. In addition, procedures must be in place to routinely monitor the quality of the fuel so that the presence of abnormal amounts of contaminants is identified and steps are taken to remove these contaminants.

All fuel-quality control efforts performed at the refinery or time of fuel purchase are designated as "Quality Assurance." All fuel quality-control efforts performed after the fuel has been delivered to the Government are classified as "Quality Surveillance." This chapter outlines the absolute minimum steps that shall be taken in order to:

1. Monitor the quality of the fuel being handled and delivered to aircraft.

2. Control and minimize the introduction of typical contaminants (water and particulates).

The detailed operating procedures contained in Chapter 18 and the maintenance procedures of Chapter 19 incorporate many of these monitoring and quality-surveillance steps.

15.2 AVIATION FUEL QUALITY SURVEILLANCE PROGRAM

All units that refuel aircraft shall establish a formal fuel quality surveillance program. Samples shall be taken from the refueling nozzle of each aircraft refueling point, mobile refueler, truck fill site, bulk receiving point, etc., and tested for water (by FWD or Aqua-Glo), sediment (by CCFD, Color Patch Test, or gravimetric test), and API gravity (by API hydrometers). Visual inspections shall also be taken for spot checks. All units shall record all test results in a log, similar to Figure A-1 in Appendix A, along with the date, approximate time, source (tank, refueler, filter/separator, refueling nozzle, etc.), and other appropriate information. This shall be done for visual as well as machine run tests. Such records shall be used to monitor equipment performance and to provide an audit trail.

The following paragraphs establish the minimum sampling and testing requirements for aviation fuels. They shall be treated as the minimum requirements and shall not preclude more frequent or extensive testing should contamination be suspected. MIL-STD-3004 contains analogous information regarding fuel sampling and testing requirements. In the event of a conflict between the requirements of this NATOPS Manual, MIL-STD-3004, and TM5-6630-218-1, this NATOPS Manual takes precedence.

15.2.1 Fuel Receipts. The following paragraphs contain the absolute minimum tests that shall be performed when receiving fuel at tactical sites.

WARNING

If for any reason it is suspected that the product being received has been significantly contaminated with other fuels, petroleum products, or other materials, a special sample shall be taken and a complete set of fuel specification tests shall be performed. Failure to identify and reject contaminated fuel can negatively affect aircraft safety-of-flight.

In addition to the routine samples that are immediately tested during fuel receipt, the operator shall obtain a 1-gallon retention sample that is representative of shipments received from other than internal unit sources. These samples shall be tagged, logged, and stored in an approved storage cabinet and retained for 60 days or until one of the following conditions occur:

1. The product represented by the sample is consumed.

2. The product becomes nonrepresentative of the sample held.

A shipment of fuel can be received even if it fails particulates or free water limits (e.g., 2 mg/l solids or 5 parts per million (ppm) water); however, precautions shall be taken to ensure the product meets requirements prior to issue into aircraft. Close attention shall be payed to filtering and monitoring devices.

15.2.1.1 Fuel Received by Tank Car or Tank Truck. Ensure that seals are intact and the numbers correspond to those on the shipping document if/when provided. Before connections with the receiving system have been made and fuel flow initiated, take an all levels sample from the delivery vehicle/tank and conduct the following tests:

1. Color

2. Appearance

3. API gravity.

If the product is clear and bright in appearance and the API gravity is within 0.3 degrees of the shipping document (DD Form 250, Material Inspection and Receiving Report, or delivery invoice as provided by external sources), receipt of the product shall be continued. A second sample shall then be taken downstream of the pumping and filtering equipment and tested for:

1. Particulates (visual)

2. Free water (visual)

3. Flash point (JP-5 and JP-8 fuels only)*

4. FSII (turbine fuels only).*

*When testing capabilities are available.

15.2.1.2 Fuel Received by Bulk Transfer Line (e.g., AAFS). Fuel received via bulk transfer lines shall be of the required quality prior to receipt. Prior to fuel flow being initiated, immediately take a source sample and conduct the following tests:

1. Color

2. Appearance

3. API gravity.

If the product is clear and bright in appearance and the API gravity is within 0.3 degrees of the shipping document of the shipping document (DD Form 250, Material Inspection and Receiving Report, or delivery invoice as provided by external sources), receipt of the product shall be continued. A second sample shall then be taken from the transfer line and tested for:

1. Particulates (visual)

2. Free water (visual)

3. Flash point (JP-5 and JP-8 fuels only)*

4. FSII (turbine fuels only)*

5. API gravity

6. Particulates (CCFD or gravimetric method)

7. Free Water (FWD or Aqua-Glo).

*When testing capabilities are available.

15.2.2 Fuel in Collapsible Storage Tanks. Fuel tanks must be kept as clean and dry as possible. Recirculation and sampling shall be conducted daily. Fuel samples shall be taken from the nozzle and in accordance with paragraph 15.2.3. Fuel stored in a collapsible tank which is not in continuous use shall be sampled monthly and laboratory tested for sediment and water.

15.2.3 Fuel Issued to Aircraft. Fuel in refueler trucks, fueling systems, or other dispensing equipment shall be recirculated (flushed) through the equipment/system's hoses and refueling nozzles and back to a tank each day prior to the first refueling of the day. After recirculation the fuel shall be sampled at the nozzle and visually tested for:

1. Color
2. Appearance
3. Free water
4. Particulates.

At least once a week the samples from each refueling system or equipment shall be taken and tested for particulates and free water using the CCFD, color patch test, ASTM gravimetric test, FWD, and/or Aqua-Glo, as appropriate and available.

Note

Two separate samples are required when running both a particulates and a free-water test to ensure correct quantity of fuel is available. Fuel that has been tested for particulates, free water, or FSII shall not be reused to run any other test since this practice could lead to inaccurate results.

Recirculation (flushing) and testing is required on any equipment/system that has not been used in refueling operations for 24 hours. In addition, daily random sampling from the refueling nozzle of equipment/systems and testing via appropriate test equipment and procedures for water and sediment are highly recommended.

15.2.4 Routine Verification Sampling and Testing. Each operating unit shall take a series of routine, duplicate verification samples to verify that in-house testing procedures and equipment are working properly.

As an absolute minimum, each unit will draw two duplicate samples (four 1-quart bottles). Process each duplicate set of samples as follows:

1. Randomly select a refueling system/point, refueler truck, etc.
2. Extract two 1-quart samples, one immediately after the other, from the refueling nozzle of the system while it is being recirculated.

Note

If more than one set of duplicate samples is being taken at one time, appropriate steps must be taken to assure the source of each set of samples can be positively identified.

3. Test one of the samples using the units particulate testing equipment. Record the results in a log similar to Figures A-2 and A-3.
4. Complete a fuel sample label (see Figure A-4) and attach it to the second (duplicate) sample. The results obtained from the units particulate testing equipment shall be entered in the remarks column on this label.
5. Ship the labeled, second (duplicate) sample to a supporting/regional fuel testing laboratory (see Appendix B of MIL-HDBK-844(AS) for a list of laboratories) for testing of the particulates (using the ASTM D 2276 gravimetric method) or FSII as indicated on the sample's label.
6. When results from the regional laboratory are received, enter them into the appropriate log next to the results obtained using the unit's test kit. Compare the two results on the duplicate samples to verify the accuracy of the test kit.

15.3 SAMPLING PROCEDURES

Proper sampling of petroleum products is as important to quality surveillance as proper testing. Improper containers and poorly-drawn or mishandled samples

can cause meaningless, inaccurate, and misleading laboratory results.

Directions for sampling cannot be made explicit enough to cover all cases. Judgment, skill, and experience should supplement any group of instructions. Consequently, personnel assigned to take samples shall be trained, experienced, competent, and conscientious. The responsibility for taking and preparing samples shall not be lightly delegated.

This section provides general information on petroleum sampling techniques and practices. For more detailed information and instructions including descriptions of the various types of samples common to the fuels community, consult ASTM Standard Practice D-4057.

15.3.1 General Rules

1. The sampler's hands shall be clean.

2. Sample containers, clear glass quart bottles or LDPE/HDPE plastic bottles, shall be meticulously cleaned (washed with an appropriate laboratory detergent). Wipe bottles clean with lint-free cloths (i.e., MIL-C-85043 Type II).

Note

Alcohol shall not be used to clean sample bottles.

3. Samples shall be representative of the product being sampled. Samples shall be taken with the system operating at normal flow rates and steady state. Samples drawn during static (no flow) conditions are not representative of the full fuel flow and will give false results.

4. Samples shall be capped promptly, protected from light, and handled expeditiously.

5. Samples taken for shipment to shore laboratories shall be taken only in 1-quart glass sample bottles. Glass sample bottles for shipment to shore laboratories shall be filled to 1 inch below the cap.

6. LDPE/HDPE plastic bottles are authorized for use for the collection of particulate and free water fuel samples.

7. LDPE/HDPE plastic bottles shall be marked for the appropriate level (800 ml or 500 ml) and filled only to this mark.

8. Samples taken to test filter/separator efficiency shall be taken at the filter discharge.

9. Visual samples shall be taken in clear glass bottles only.

15.3.2 Sample Containers. The following fuel sampling bottles, containers, kits and safety cans are available through the supply system and are the only type authorized for the collection, retention, and submission of aviation fuel samples.

1. Kit, Fuel Sampling. A complete kit consisting of metal shipping container, cushioning material (inner-pack), and four 1-quart sample bottles, NSN 8115-00-719-4111.

2. Cushioning Material. Replacement top/bottom packing material for the above fuel sampling kit, NSN 8115-00-719-4825.

3. Replacement Kit. Replacement bottles and tags for the above fuel sampling kit, NSN 8115-00-717-8572.

4. Container, Fuel Sample. A 1-gallon, 24-gauge steel, epoxy resin lined fuel sample can suitable for the shipment or retention of fuel samples, NSN 8110-00-128-6819.

5. Drum, Shipping and Storage. A 5-gallon, 24-gauge steel, epoxy-lined fuel sample container suitable for shipment or retention of fuel samples, NSN 8110-00-400-5748.

6. Bottles, Glass, Clear. Six 1-quart clear glass bottles (without tags) suitable for taking visual samples and for shipping fuel samples to shore laboratories, NSN 8125-00-378-9994.

7. Bottles, LDPE/HDPE Plastic. Plastic bottles suitable for taking particulate and free water samples are available in two sizes:

   a. 1000 ml, NSN 6640-01-300-3541 (6 bottles)

   b. 500 ml, NSN 6640-01-461-1016 (12 bottles).

8. Container, Safety Can. Containers for the safe storage and transport of used fuel are available in two sizes:

   a. 1 gallon, NSN 7240-00-177-4999

   b. 5 gallon, NSN 7240-00-178-8286.

15.3.3 Identification of Sample. All samples sent to a fuel testing laboratory shall be individually tagged with a label (see Figure A-4) containing the following minimum information:

1. The originating activity's name and address. A point of contact and phone number should be included.

2. Sample serial number (sampling activity's designation assigned to this particle sample).

3. Type fuel.

4. Date sample was taken.

5. Approximate time sample was taken.

6. Source of the sampling point (nozzle sample or refueler number).

7. Name of the person who drew the sample.

8. Classification of sample and tests required (see paragraph 15.3.4).

   a. ROUTINE Monthly Verification (Insert locally determined particulate results in the (CCFD) space provided on the sample label. If this result has been determined by either the matched weight test or gravimetric test methods rather than by CCFD, draw a line through "CCFD." The B/2 results shall be inserted in the appropriate space if available.)

   or

   b. SPECIAL (list tests required and/or pertinent remarks. This is especially important when sending in special samples. The comments will assist laboratory personnel in determining what additional tests should be performed).

15.3.4 Sample Classification. All samples shipped to a fuel testing laboratory shall be classified either ROUTINE Verification or SPECIAL.

15.3.4.1 Routine Verification Sample. Routine Verification samples are taken when no fuel problems or aircraft problems attributable to fuel are known or suspected.

15.3.4.2 Special Sample. Special samples are submitted for testing because the quality of the fuel is suspect either as the result of aircraft malfunctions or for other reasons. Special samples have the highest priority in handling, testing, and reporting.

15.3.5 Shipping Instructions. Samples are to be forwarded to appropriate testing laboratories by the most expeditious means. A listing of military petroleum laboratories is included in MIL-HDBK-844(AS).

Wherever feasible, samples shall be delivered directly to the laboratory by special courier.

Samples to be shipped by military aircraft shall be packed in accordance with the requirements of the manual on Packing and Handling of Dangerous Materials for Transportation by Military Aircraft (AFM 71-4/TM 38-250/NAVWEPS 15-03-500/MCO P4030.19). The sampling kit listed in paragraph 15.3.2 meets these requirements.

WARNING

New sample bottle caps shall be used for all new samples pulled with this sample kit.

15.4 FUEL TESTING STATION, TEST EQUIPMENT, AND METHODS

15.4.1 Fuel Testing Station. Once deployed, each tactical unit shall set up fuels testing equipment in a centralized, convenient, and reasonably protected (e.g., tent) location so that accurate test results can be obtained in a timely manner. In addition, each unit that refuels aircraft shall identify a fuel testing laboratory such as one of the regional laboratories listed in MIL-HDBK-844(AS), which is capable of performing complete fuel analysis and is conveniently located for sample shipment and results reporting.

15.4.2 Testing Equipment. Each unit that refuels aircraft shall maintain the following aviation fuel test equipment. Local allowances shall be established for test equipment required to meet the minimum quality surveillance requirements of this manual.

15.4.2.1 Particulate Testing Equipment. Each unit shall have one of the following instruments/or kits for evaluating the particulate contamination of fuel:

1. Combined Contaminated Fuel Detector (CCFD). This instrument is used to analyze the particulate contamination in a sample of fuel. Currently, the only CFD being procured is the CCFD, NSN 6640-01-013-5279, which includes a built-in FWD Viewer Kit. The regular CFD, NSN 6630-00-706-2302, is still available and may be used; kits are available to convert to a CCFD by adding a FWD portion as part of an upgrade/repair. Additional materials needed to conduct tests:

    a. Filter Element, Fluid, 0.65 micron — (NSN 6630-00-877-3157)

    b. Filter, Wratten — (NSN 6630-00-849-5288)

    c. Sample bottle.

2. ASTM D 2276 Gravimetric Test Method Equipment.

    a. Filtration apparatus (glass or stainless steel with proper grounding and bonding equipment)

    b. Vacuum pump

    c. Membrane filters

    d. Sample bottle

    e. Thermal drying oven.

3. In-line Sampling/Color Patch Assessment Method. See Marine Corps TM 01461B-12&P/1 or Army TM 10-6630-240-12&P for stock numbers (NSNs) of items included in the Aviation Fuel Contaminant Test Kit.

    a. Monitor Kit, Fuel Sampling

    b. Single Filter Monitor, Millipore

    c. Matched Weight Monitor, Millipore

    d. Aviation Turbine Fuel Contamination Standards

    e. Receiving can or vessel.

15.4.2.2 Free Water Detection Equipment. Each unit shall have one of the following instruments/or kits for evaluating the free-water content of fuel:

1. Viewer Kit, Free-Water Detector (FWD), (NSN 6640-00-999-2786). This instrument is used to determine the free-water content of aviation fuels. Additional materials needed to conduct tests:

    a. Detector Pad, Free Water — (NSN 6640-00-999-2785)

    b. Standard, Free Water — (NSN 6640-00-999-2784)

Note

Since free-water standards deteriorate with exposure to ultraviolet light, the standards shall be changed and dated every 180 days.

2. Aqua-Glo Water Detection Kit, Gammon GTP-323 (NSN 6640-01-138-2563)

    a. Water Detector Pads (NSN 6640-00-235-3820)

15.4.2.3 Density Measurement Equipment. Each unit shall have the following API hydrometers in order to determine the API gravity of the fuel.

1. Hydrometer, Graduate 29 to 41 degree range, JP-5/8, NSN 6630-00-242-9258

2. Hydrometer, Graduate 39 to 51 degree range, JP-5/8, NSN 6630-00-245-8376

3. Hydrometer, Graduate 49 to 61 degree range, JP-4 and MOGAS, NSN 6630-00-245-8377

4. Hydrometer, Graduate 59 to 71 degree range (JP-4 and MOGAS) NSN 6630-00-245-8374.

15.4.2.4 FSII Measurement Kit. Each unit shall have a B/2 Anti-Icing Test Kit or Fuel System Icing Inhibitor (FSII) Refractometer, NSN 6630-01-165-7133. This device is used to determine the FSII content of aviation fuels.

15.4.2.5 Pensky-Martens Closed Cup Flash Point Tester, NSN 6630-00-530-0987. This tester shall be used to determine the flash point of a fuel sample. It is absolutely essential that all activities possess this instrument since the flash point of any fuel removed from an aircraft must have its flash point tested in order to determine its disposition.

15.4.3 Test Methods. Instructions for performing the appearance or visual test, the backbone of any fuel quality surveillance program, are presented in paragraph 15.5.1. Instructions and procedures for conducting tests with the equipment listed in paragraph 15.4.2 are contained in either the operating manuals provided with each test instrument at the time of procurement or in the aviation test kit's supporting publication, TM 5-6630-218-10.

15.5 INTERPRETATION OF TEST RESULTS

To be acceptable for delivery to aircraft, aviation fuel must be clear and bright and contain no visual detectable free water.

WARNING

Personnel refueling aircraft shall cease fueling operations immediately upon detecting any departure from acceptable criteria. Refueling personnel shall inform the pilot, maintenance officer, or other designated person in charge as to the condition of the fuel delivered. Failure to identify and stop refueling operation can lead to loss of aircraft, pilot, and crew.

When off-specification fuel is identified, the refueling truck or other source of fuel will be placed out-of-service pending investigation and other corrective action that may result. The pilot, maintenance officer, or other person in charge, when notified that doubtful or contaminated fuel has been delivered to an aircraft, will take action to determine whether the aircraft shall be defueled and cleaned.

15.5.1 Appearance (Visual Test). The test shall be conducted using a round, transparent, glass bottle, 1 quart to 1 gallon in size. The bottle shall be clean. The sample is first visually inspected for color and presence of foreign matter. The sample shall then be swirled to form a vortex. Particles coarse enough to settle will collect as sediment on the bottom of the bottle directly beneath the vortex.

A passing sample shall be "clear and bright," which means free of any cloud, emulsion, or readily visible particulate matter. Aviation turbine fuel (JP-4, JP-5, JP-8 or commercial Jet A or Jet A-1) should be colorless to straw-yellow. When any appreciable contamination is found, the test shall be repeated, paying particular attention to cleaning and rinsing the container prior to sampling. Also, if there is any question as to the quality of the fuel, both particulate and water measurements must be made using the aviation fuel test kit.

15.5.2 Particulates. Solid contaminants such as rust and dirt can be held well below a level of 1 mg/l in a properly functioning fuel distribution system. If solid contaminants at aircraft dispensing points exceed 1 mg/l when tested by CCFD or gravimetric methods, investigate and take corrective action to improve fuel quality.

Field testing of turbine fuels using the in-line sampling method for particulate contamination should be conducted on a regular basis at the same sampling point to ensure accurate results over a sustained period. Follow the procedures delineated below:

1. If a contamination monitor (single membrane) shows a 2 or higher reading, run a second test with the matched weight monitor (double membrane).

2. If the difference is more than 2 numbers, do not use the fuel until a CCFD or gravimetric test has been completed.

3. If the top membrane is rated 5 or darker, the fuel must be tested using the CCFD or gravimetric test method before use, regardless of the color of the lower membrane.

WARNING

If solid contaminants exceed 2 mg/l or a 5 or higher color standard (any scale), delivery of fuel to aircraft shall be stopped and corrective measures completed prior to resumption of fueling operations. Loading aircraft with fuel with excessive contamination can result in a malfunction and/or subsequent loss of aircraft, pilot, and crew.

15.5.3 Free Water. Satisfactorily performing filtering and monitoring devices will provide fuel containing less than 5 ppm of free water. Should the level of free water in fuel at an aircraft dispensing point exceed 5 ppm, a second sample shall be taken immediately to ascertain if the second sample confirms that the free water exceeds 5 ppm. If so, fueling shall be stopped until changes in procedure and equipment that reduce the free water to 5 ppm or below are effected.

CAUTION

During the receipt of fuel into a storage tank, if the other tests are satisfactory, but the particulate and/or free-water contamination is high, extra testing and surveillance shall be conducted downstream to assure that this contamination is reduced by filtration to acceptable levels before dispensing to aircraft.

15.5.4 FSII. FSII performs two important functions that help to avert significant safety-of-flight problems. First, it prevents the formation of water-ice in aircraft fuel systems, that can occur in certain susceptible aircraft. Second, FSII acts as a biostat preventing the growth of various microorganisms that can contaminate fuel systems, block filters, and promote corrosion.

The minimum level of FSII in fuel for USN/USMC aircraft requiring FSII to prevent water-ice formation is 0.03 percent. The minimum level of FSII in aviation turbine fuel for other US services' and foreign aircraft is 0.07 percent.

Tactical units have no means of raising the FSII level of their JP-5 (or other turbine fuel). FSII materials are mutagenic and considered to be dangerous in the neat state; however, they are safe once blended into the fuel. Injection of FSII is prohibited at the unit level. Refer to MIL-HDBK-844(AS) for guidance on raising FSII level by commingling fuel between tanks.

If the FSII level falls below the 0.03-percent limit, the appropriate squadron CO or his/her designated representative shall be notified. Notification is required for S-3, US-3, and SH-60 aircraft only. The applicable NATOPS Aircraft Flight Manual shall be consulted by the pilots for operating instructions, which will avoid resultant safety-of-flight problems.

Transient (USAF, USA, and visiting foreign military aircraft) crewmembers and pilots will be notified of low FSII (levels of 0.07 percent or less) so that they may consult their appropriate technical directives for special operating instructions necessary to avoid water-ice induced problems.

WARNING

Failure to notify appropriate squadron personnel of low FSII condition can result in safety-of-flight problems.

Note

The B/2 Anti-Icing Test Kit Refractometer contains two FSII scales, one for each of the two different FSII materials currently in-use. All JP-5 fuel tested shall be assumed to contain the high flash point type of FSII material, Diethylene Glycol Monomethyl Ether, or DiEGME, which is read on the scale of the B/2 refractometer marked "JP-5" or "M."

15.5.5 Other Tests Results. The results of testing performed by supporting activities' laboratories shall be evaluated by comparison with the limits described in Appendix B, which list the Deterioration Use Limits for Aviation Fuels. The limits in these two figures refer specifically to the acceptability of aircraft fuels for delivery to aircraft. The particular source for which the fuel is being removed and the one into which it is being loaded must be considered when applying these use limits; a limit on free water of 5 parts per million (ppm) maximum or 2 mg/l on particulates may not be applicable to a sample for a large shipment if

subsequent cleanup in the fuel handling system can be anticipated.

Any unit that suspects other chemical contamination, deterioration during storage, or other unusual contamination or condition shall send fuel samples to an appropriate fuel laboratory (see Appendix B of MIL-HDBK-844(AS)) for testing. Samples must be clearly labeled as discussed under identification of sample above with information about the suspected problem included in the remarks section.

WARNING

Failure to identify contaminated fuel and removal from use can result in reduced aircraft engine performance, malfunction, or catastrophic failure.

Inquires pertaining to the quality or testing of aviation fuels and lubricants may be addressed to COMNAVAIRSYSCOM (AIR-4.4.5), with a copy to NAVPETOFF.

15.5.6 Routine Verification Samples. Tactical units that use either the CCFD or gravimetric method for particulate determinations shall take duplicate routine monthly verification samples to compare test results obtained by the unit's in-house test kit(s) with those obtained by another fuel laboratory on the duplicate sample (see paragraphs 15.2.4 and 15.3.4.1). Some variation between the two test results is possible because of errors introduced by the shipment and storage of the duplicate fuel sample as well as differences in the test techniques. No action is necessary unless differences between the two results are significant (greater than 0.8 mg/l). When differences are significant, review the testing procedure, and submit and test more duplicate verification samples. If results are still unacceptable, contact AIR-4.4.5 at NAVAIR for further guidance.

Tactical units that possess FSII test kits shall also take duplicate monthly verification samples, test one at the tactical base and send one to a regional laboratory for verification testing. Results obtained by the tactical unit and the regional laboratory may vary by as much as 0.03 percentage points and still be considered acceptable. If greater differences are noted, review the procedure, recalibrate the instrument, and test additional verification samples. If results are still out of the acceptable range, contact AIR-4.4.5. If may be necessary to procure a new refractometer.

15.6 GUIDELINES FOR REQUESTING LABORATORY SERVICES

1. FMF units shall forward samples to a military laboratory in the geographic region, if practicable. See Appendix B of MIL-HDBK-844(AS) for a list of laboratories.

2. Decisions as to which laboratory to utilize shall be based upon laboratory proximity, capabilities, and responsiveness.

Note

Not all laboratories are available for regular recurrent testing on a no-cost basis.

15.7 REGIONAL LABORATORY TEST METHODS AND REPORTING

The following paragraphs provide instructions to regional laboratories that receive fuel samples from an FMF unit.

15.7.1 Routine Samples. Regional laboratories receiving samples from tactical units for routine fuel quality checks shall test the samples as requested on the sample label for one of the following properties using the listed ASTM method:

1. Particulate matter (sediment), ASTM D 2276

2. FSII content, ASTM D 5006

3. Flash point, ASTM D 93.

Laboratories shall also note the presence of significant amounts of free water in the bottoms of sample containers. Laboratories shall not run free water determinations on routine samples since the free-water content of the fuel is severely affected by normal shipping and handling of the sample and results are meaningless.

Note

All JP-5 fuel tested shall be assumed to contain DiEGME.

15.7.2 Special Samples. Regional laboratories receiving special samples for testing shall conduct requested tests in accordance with methods authorized by the applicable fuel specification.

15.7.3 Reporting. Regional laboratories performing testing shall report the results to the following:

1. Original — Tactical unit submitting the sample.

2. One copy — Commander
   Naval Air Systems Command (AIR-4.4.5)
   22229 Elmer Rd., Unit 4
   NAS Patuxent River
   Patuxent River, MD 20670

15.7.4 Report Forms. Regional laboratories are requested to report results in a form similar to Figure A-5 in Appendix A. If CCFD and/or B/2 results are reported by the tactical unit on the sample's label, regional laboratories shall include them with the results obtained on the fuel samples.

15.7.5 Distribution Lists for Reports. It is the responsibility of the tactical unit submitting samples to a laboratory to provide the laboratory with the desired distribution of reports in accordance with paragraph 15.7.3 above.

15.7.6 Message Reports. When a "special" fuel sample has been tested and the results exceed the deterioration use limits of Appendix B, the testing laboratory will report the findings as soon as possible by telephone to the aviation activity that submitted the sample. The telephone report shall be followed by a message report. During nonworking hours, the aviation activity's duty officer shall be notified of the test results. It is unnecessary to report test results via telephone or message for "routine monthly verification samples" which exceed the use limits for particulates; however, if the FSII content is found below the 0.03 limit a telephone and message report is required.

15.8 PROCEDURES FOR PREVENTING AND CONTROLLING CONTAMINATION

Contamination of aircraft fuel can be prevented only by the use of proper equipment and by carefully following proper operating procedures. Daily recirculation and fuel delivery/dispensing through a filter/separator that removes both water and particulates will help ensure that fuel is clean and dry. Special fuel quality filter/monitors that restrict or shut off the flow of fuel if exposed to excessive water or particulates are used in conjunction with, and downstream of, filter/separators within all dispensing assemblies.

The proper care, operation, and maintenance of these systems are essential in assuring that only clean, dry fuel enters aircraft. As a minimum, operators should:

1. Observe the pressure drops at least daily across all filter/separators and fuel monitors in accordance with applicable technical manuals.

Note

Pressure drop readings depend on the flow rate of the fuel through the filter. Meaningful readings can be obtained only if the system is operating at normal flow conditions during recirculation or flushing.

2. Take every precaution possible to prevent the introduction of any particulate matter (dirt) into the fuel. (See discussion in the MIL-HDBK-844(AS).)

3. Install and maintain dust-tight caps or covers on all openings and connections, including refueling nozzles. These caps shall be removed only when item or system is in use.

CAUTION

To prevent a FOD hazard, component caps and plugs shall be attached either to the owning equipment or removed from the vicinity of aircraft refueling operations.

4. Brush away or remove any accumulated dirt or sand around tank flanges, manholes, etc. before opening/removing.

5. Never leave a storage tank, refueler truck, or other vessel open to the air any longer than absolutely necessary.

6. Do not operate any fuel handling equipment unless all filters, monitors, strainers, screens, and

nozzle spout caps are properly installed and in place.

7. Never remove any filter, strainer, or screen for any purpose except cleaning or maintenance. Always replace filter or screen immediately after cleaning.

8. Observe and report any unusual accumulations of matter in nozzle screens to the FO/FC.

9. Observe water that is drained from refueler and filter/separator sumps. It should appear clean. Report any unusual accumulation of foreign matter/sediment to the FO/FC.

10. Drain (strip) and check all refuelers, tanks, filter/separators, and equipment provided with manual drains daily.

11. Circulate stagnant product in refueling equipment to remove condensate and particulate contaminants from lines, hoses, and nozzles prior to aircraft issues. This is mandatory for any refueling equipment that has not been in use for a period exceeding 24 hours. Minimum circulation time must be determined locally for each piece of equipment depending on its configuration and size as well as fuel flow rate. Allow sufficient time for the fuel in the piping and hose(s) downstream of the fuel filter/monitor to be completely replaced by clean, dry fuel.

12. Ensure that regularly scheduled maintenance is properly performed in accordance with applicable Technical Manuals and Directives.

13. If Federal/State/local environmental protection laws allow, keep refueler tanks filled when not in use or when no defueling is anticipated.

14. Never use the same system/equipment with a different fuel until all equipment has been properly purged.

15. Check fuel product markings on each separate piece of equipment for agreement before initiating any fuel transfer operation.

16. Never load or carry two different aviation fuels in one refueler.

17. Use separate hoses and equipment for each product.

18. Report and investigate any suspected contamination or any other unusual accumulation of foreign matter. The FO shall be responsible for initiating investigations and formulating corrective actions.

19. Report and correct any leaks.

20. Never use equipment configured solely as a defueler for refueling aircraft.

21. Use padlocks to secure manhole covers on items such as refueler trucks and SIXCON tank modules.

CHAPTER 16

Safety in Tactical Fuel Handling Operations

16.1 INTRODUCTION

This chapter contains safety procedures and requirements that are either general in nature and therefore not covered by the other chapters of this manual or are extremely important and repeated here for emphasis. Safety requirements emphasized in U.S. Marine Corps Technical Manual, TM-3835-15/1, have been incorporated in this chapter. Any departure from the procedures of this chapter may adversely affect the overall safety of the operation being performed.

Although the procedures and requirements contained in this manual are as complete as possible, they are no substitute for thorough knowledge of aviation fuels and their inherent characteristics and dangers. All aviation fuels personnel shall therefore be completely familiar with the information contained in MIL-HDBK-844(AS), Technical Manual TM-3835-15/1, and equipment associated publications/ directives. Refueling personnel can best avoid or correct unsafe situations by knowing and understanding aviation fuel hazards.

The development of safe and efficient fuel handling and aircraft refueling procedures is a continuously evolving process. Therefore, standard operating procedures (SOPs) governing fuel handling operations in a field environment shall be published and reviewed annually.

Scientific investigations are coupled with actual field experience in order to establish the safest and simplest procedures possible. One of our most important sources of information in this process is the investigation of field accidents or problems. Therefore, it is extremely important that knowledgeable personnel be involved in accident investigations, especially whenever explosions or fires have occurred. Units should therefore request the assistance and participation of experts whenever major fuel related accidents are being investigated to ensure that correct conclusions are drawn. NAVAIR and NAVPETOFF can assist in the identification of appropriate experts.

16.2 ELIMINATING SOURCES OF IGNITION

16.2.1 Reducing Electrostatic Charges. One of the primary sources of ignition is static electricity.

To ensure the safe relaxation of static charges relevant to fuel operations, all units shall:

1. Prohibit the top loading or splash filling of any rigid fuel vessel; e.g., M970, Aviation Refueling Capability (ARC), or SIXCON fuel tanks.
2. Refill filter or monitor vessels slowly whenever they have been drained.
3. Keep tanks free of foreign objects that may become unbonded charge collectors; e.g., small conductive objects that can be floated by foaming fuel.
4. Always electrically bond the refueling equipment to the aircraft or truck into which the fuel is being loaded.

Note

All static electrical grounding points used for grounding aircraft during refueling (hot or cold) shall be tested after establishing the refueling point and checked weekly to ensure a 10,000 ohm or less resistance. Aircraft-refueling points shall be tested weekly, or when any change occurs in the status of the grounding point (movement of grounding rod, change of static grounding reel, etc.), to ensure a 10,000 ohm or less resistance is maintained. If testing equipment is unavailable, refer to MIL-HDBK-274 for grounding procedures.

5. Ground for all hot refueling operations.
6. Bond refueling nozzles to the aircraft or truck into which the fuel is being loaded using a separate bonding pig-tail before tank caps are removed. This is absolutely critical for overwing (gravity) refueling nozzles since this is the only way to ensure metal-to-metal contact between the refueling nozzle and the aircraft throughout the refueling operation.

7. Attach bonding cables to aircraft using plug and jack method whenever available.

8. Inspect bonding and grounding cables, clamps, and plugs daily basis.

9. Check the electrical resistance of cables and pig-tails monthly. Replace if defective.

10. Do not conduct fuel operations during electrical storms.

11. Remove refuelers from aircraft parking areas during electrical storms.

12. Ground all individual components that require grounding (3″ meter, pump, filter-separator, monitor, etc.).

Note

All individual components requiring grounding that are in place for more than a 10-day period shall be tested to ensure a 10,000 ohm or less resistance is maintained. Component grounding points shall be tested monthly or when any change occurs in the status of the grounding point (movement of grounding rod, change of component, grounding cable, etc.) to ensure a 10,000 ohm or less resistance is maintained. If testing equipment is unavailable, refer to MIL-HDBK-274 for grounding procedures.

13. When providing grounds for use by mobile refueling equipment (ARC, M970, SIXCON, etc.) for the purpose of refueling aircraft, individual verification of each separate aircraft grounding point is not required. Instead, a generalized verification shall be conducted in the geographical location (FARP site, FOB, etc.) to ensure a suitable ground (less than 10,000 ohms resistance) can be maintained. Mobile refueling equipment parking area grounding points shall be checked prior to being used and verified weekly or when any change occurs in the status of the grounding point.

16.2.2 Eliminating Other Sources of Ignition. To prevent or eliminate sources of ignition, units shall:

1. Prohibit fuel personnel from wearing shoes that have nails or other metal devices on the soles.

2. Advise fuel personnel not to carry or wear loose metal objects, such as knives or keys.

3. Check the exhaust piping on mobile refuelers daily to ensure that holes, cracks, or breaks do not exist.

4. Prohibit smoking, spark or flame producing items, open flames, or hot work within 50 feet of any refueling operation.

5. Defer all repair work on fueling equipment during fuel handling operations.

6. Avoid introducing lights (except approved safety lights for use in hazardous locations) into any compartment or space where fuel or flammable vapors may be present. (API has determined that ordinary commercial two- and three-cell flashlights, using carbon zinc dry cell batteries, may be used safely around flammable fuel/air mixtures. Tests have proven them incapable of igniting vapors, even if accidentally dropped or the light bulb is crushed.)

WARNING

Always assume that fuel vapors (in a tank or above a pool of fuel) are in the flammable range; i.e., proper fuel-air mixture to ignite.

7. Prohibit fuel personnel from carrying “strike anywhere” matches or cigarette lighters around fuel systems/equipment.

8. Ensure that no repair or maintenance work is being conducted on the aircraft before starting the refueling or defueling operation.

9. Ensure that liquid oxygen (LOX) operations are not being performed and LOX handling equipment are not located within 50 feet of fuel operations.

10. Be certain that aircraft radar and all unnecessary radio equipment is switched off before refueling or defueling is begun. If it is necessary that equipment be warmed up prior to an immediate launch, be sure that it is not transmitting. The only exception to this rule occurs during hot refueling.

Hot refueling operations require the pilot to keep in radio contact with the tower at all times.

11. Prohibit aircraft fuel handling operations within 300 feet of ground radar equipment.
12. Equip all internal combustion engines operated within 50 feet of fuel handling operations with spark arresting type mufflers.
13. Do not start or stop any engine, regardless of its configuration, within 50 feet of a fueling or defueling operation. This prohibition includes aircraft being serviced and adjacent aircraft, as well as ground support equipment. The starting or stopping of an engine within 50 feet of a fueling or defueling operation is sufficient cause for the operator to immediately shut down the fuel pump.
14. Open valves slowly to avoid or minimize any splashing in tanks.
15. Conduct open port/over-wing refueling only as a last resort and then only if operational necessity or aircraft design dictates.
16. Unless rapid turnaround of aircraft is required, hold hot refueling operations to the absolute minimum possible. Studies show that cold refueling operations are inherently safer, are more cost-effective (less FARP operations), and are therefore preferred to hot refueling.
17. Ensure that personnel do not become entangled working in and around fuel handling equipment.

16.3 REDUCING OR CONTROLLING VAPOR GENERATION

In order to help prevent fires by reducing or controlling vapor generation, units shall:

1. Avoid handling aviation fuel in open containers.
2. Avoid refueling, defueling or draining aircraft, or conducting fuel handling operations in a hangar or confined area, except for the removal of water and the extraction of samples from aircraft low point drains. This does not apply to structures specifically designed for these operations.
3. Keep all fuel containers, such as aircraft fuel tanks or vessels, closed except when necessary to open for actual operation.
4. Avoid spilling fuel during fuel handling operations.
5. Take immediate action to clean up any spills that occur.
6. Properly dispose of oily waste or rags (in self-closing containers) immediately after using.
7. Never drive or move a refueler or defueler with a leak in the tank, piping, or other equipment.
8. Report all leaks in any portion of the fuel systems to the FO/FC.
9. Treat empty, or apparently empty, cans or containers that formerly held aircraft fuels as though they still contain fuels. These containers still contain vapors and are dangerous until vapor-freed.
10. Be aware that fuel vapors are heavier than air and will collect in low places such as sumps and berms.
11. Never dispose of waste fuel in other than approved containers or fuel-water separators.
12. Never top load or splash fill tanks. (This does not prohibit over-wing or open port refueling of aircraft that are configured for this operation.)
13. Keep all equipment and work areas neat, clean, orderly, and in good mechanical condition.
14. Ensure that firefighting equipment and extinguishers are in good condition and readily available to the maximum extent possible.
15. Never use fuel as a cleaning agent.
16. Unless specifically designed for and operational necessity dictates, fuel containers; e.g., drums, collapsible 500-gallon, which contain fuel, shall not be loaded internally to aircraft or ground vehicles unless designed specifically for that purpose.

16.4 EXTINGUISHING FIRES

All fuel handling personnel should be aware of the basic principles involved in extinguishing fires as well as the equipment used. Fuel handling personnel should also make certain that appropriate firefighting equipment as depicted by authorized allowances is in good

condition, and readily available whenever and wherever fuel handling operations are being conducted. For maximum effectiveness and safety, fire extinguishers must be operated in accordance with the specific procedures developed for each individual type. MIL-HDBK-844(AS) contains a special section on fire extinguishment, which has been extracted from NAVAIR 00-80R-14, U.S. Navy Firefighting and Rescue Manual. All refueling personnel should receive fire extinguishing training initially and annually (sustainment training) thereafter.

WARNING

Use all fire extinguishers only for their intended purpose.

16.5 MINIMIZING HEALTH HAZARDS

Aviation fuels be handled with caution because of the obvious dangers associated with possible fires and/or explosions. Additionally, these materials, themselves, present a danger to the health of fuel handling personnel. These dangers are as equally important as those of fires and explosions even though they are not so well-known. MIL-HDBK-844(AS) contains a detailed discussion of the health hazards of aviation fuels.

In order to minimize the health dangers, fuel handling personnel shall:

1. Avoid entering enclosed areas where fuel vapors are present.
2. Keep to an absolute minimum the amount of time spent breathing fuel vapors. Good ventilation of work space is essential.
3. Stay on the windward, or upwind, side of spills when it is necessary to remain in an area where a large spill has occurred.
4. Stay on the windward, or upwind, side when conducting fuel handling operations, where the formation of vapors is unavoidable, such as at a truck fill stand.
5. Stop the fuel handling operation and move to a fresh air location immediately if a feeling of dizziness or nausea occurs.
6. Avoid skin contact with liquid fuels and tank water bottoms that can contain a high concentration of FSII. If fuel or water bottoms do contact the skin, wash with soap and water immediately.
7. Never wash hands in fuel.
8. Dilute with water, then remove fuel-soaked clothing or shoes at once.
9. Wear eye protection and clothing that leaves a minimum amount of skin exposed during refueling operations.
10. Use footwear that completely covers the feet in order to provide protection against fuel spills and fires. Shoes made of fabric or other absorbent materials are not acceptable.

16.6 CONFINED SPACES

Personnel entering or working in or around confined spaces exposed to fuels and fuel vapors will encounter potential hazards such as:

1. The lack of sufficient oxygen
2. The presence of flammable or explosive vapors
3. The presence of toxic vapors and materials.

These hazards may not always be readily apparent, detectable by odor, or visually obvious to persons entering or working within such spaces. Therefore, all confined or enclosed spaces such as fuel tanks and refueler/truck tanks will be ventilated and tested prior to entry. To minimize risk, fuelhandling personnel shall:

1. Never enter a tank or vessel that has contained any fuel until all safety precautions have been followed and then only with experienced, knowledgeable supervision present.
2. Use a blower-type mask or positive pressure hose mask, boots, and gloves if it is necessary to enter a confined area where fuel vapors may be present.

More definite information regarding the hazards of confined spaces, hazardous environments, and gas-free engineering is contained in NAVSEA S6470-AA-SAF-010, U. S. Navy Gas-Free Engineering Program Technical Manual and the NAVOSH Program Manual 5100.23B. All personnel shall comply with the applicable policies and procedures specified in these manuals.

CHAPTER 17

Tactical Fuel Systems and Equipment

17.1 GENERAL REQUIREMENTS

This chapter establishes the minimum requirements for aviation fuel handling equipment utilized by deployable FMF units engaged in the refueling of aircraft.

17.1.1 Filtration Requirements. All units that refuel aircraft must pass the fuel issued to aircraft through a minimum of two fuel filtration systems (filter/separator and fuel monitor) between storage and entering the aircraft. Filtration equipment generates static electricity; therefore, all refueling systems must reduce static electrical charges to acceptable levels prior to loading on aircraft.

17.1.2 Maximum Refueling Pressure. All aircraft pressure refueling systems must limit the maximum pressure (steady flow conditions) at the aircraft's adapter to 55 psi measured at the sample port of the refueling nozzle. During the last few seconds of a refueling operation the aircraft's internal tank shut-off valves close, creating an instantaneous pressure surge within the aircraft's fuel system. The pressure control methods in every refueling operation must be able to limit surge pressures to below 120 psi. All modern aircraft are designed, built and tested for refueling within these pressure limitations.

CAUTION

In systems such as TAFDS and HERS where the refueling pressure is controlled manually, the operator must be continuously vigilant of system pressure and react immediately to slow the pump whenever pressure approaches 55 psi. The pressure gauges used at the pumps of these systems are not sensitive enough to indicate the actual surge pressure occurring in the system. Whenever the operator actually observes pressures in excess of 55 psi, surge pressure in the aircraft's system may exceed the 120 design limit resulting in tank rupture.

Note

The 120-psi surge is instantaneous and cannot be accurately quantified by someone watching a pressure gauge. Specialized equipment is needed to measure a system's maximum surge pressure. Contact NAVAIR AIR-5362 if such testing is needed.

17.1.3 Mobile Refueler Marking. All refueling equipment shall be clearly marked with the appropriate NATO Code Number contained in a rectangle as well as the common U.S. military designation. For example, JP-5 refueling trucks shall carry the following symbol as well the JP-5 designation:

F-44

A complete list of the NATO Code Numbers can be found in Annex C of NATO STANAG 1135.

Refuelers that are used as refueler/defuelers shall be marked with only the product code JP since the fuel will, in most cases, be a mixture of JP-5, JP-4, JP-8 and/or commercial jet fuels. No NATO Code Number is to be applied to such equipment.

In addition to these product identification markings, all aircraft refueling equipment shall be marked with the following:

FLAMMABLE
NO SMOKING WITHIN 50 FEET

The emergency shut-off switch for each system shall be identified with red letters, 3 inches in height.

Refuelers/defuelers/ground fuel vehicles shall be free of rusted areas, flaking paint, and running rust. When touch-up painting exceeds 20 percent of the unit surface, the entire unit should be painted.

17.2 COMMON REFUELING EQUIPMENT/ COMPONENTS

The following paragraphs provide a general description and the minimum requirements of the individual components that make up all tactical and/or deployable refueling systems including mobile equipment. As a minimum, each refueling "system" described in paragraph 17.3 below must contain at least one (except where noted) of each of the items listed in the following paragraphs.

CAUTION

The design and construction of certain pieces of equipment listed in the following paragraphs are especially critical to overall safety. For those items designated with an asterisk (*), units shall use only those manufacturers' part numbers that have been tested and approved by COMNAVAIRSYSCOM.

17.2.1 Filter/Separators. The filter/separator is the primary device used to keep aviation fuels clean and dry. Filter/separators shall be placed downstream of any fuel source and upstream of all refueling points/nozzles within any fueling system/asset.

Each filter/separator vessel shall be outfitted with the following minimum accessories:

1. Manual water drain valve from the bottom of the water sump.

2. Air eliminator valve

3. Differential pressure gauge with 1-psi graduations to adequately measure the pressure differential across the elements.

17.2.2 Fuel Quality Monitors*. Fuel quality monitors (go/no-go gauges) meeting the requirements of MIL-M-81380 shall be installed after the filter/separators in all systems that directly fuel aircraft. A pressure gauge shall also be installed on each monitor housing so that the differential pressure across the elements can be measured.

17.2.3 Relaxation Design. Relaxation chambers are not resident within most current tactical fuel systems; therefore, system layout/design must allow for at least 30 seconds of static relaxation time downstream of the fuel monitor and prior to fuel entering aircraft or other recipients. This means that at the highest possible flow rate of the system, it will take more than 30 seconds for the fuel leaving the fuel quality monitor to reach an aircraft (or truck) refueling nozzle.

17.2.4 Fuel Meters. Meters used for service such as fueling aircraft need not be the temperature compensating type found in fixed (shore-based) facilities. Tactical systems' meters are accurate only to within ± 5 percent, and calibrations are done by the operator in accordance with TM 3835-10/1 and TM 3835-15/1.

17.2.5 Hoses and Couplings. All hoses and couplings used in tactical systems shall be in accordance with TM 3835-10/1 and TM 3835-15/1.

17.2.6 Hose End Pressure Regulator*. Hose End Pressure Regulators are not resident within the Marine Corps tactical refueling systems at this time; however, there is an ongoing effort to add these items where needed. In the interim, the following standard applies: FUEL DELIVERY TO AIRCRAFT SHOULD NOT EXCEED 55 psi.

17.2.7 Aircraft Refueling Nozzles*

1. Single Point Refueling (SPR) nozzles (also referred to as under–wing, type D–1, D–1R, D–2 or D–2R) — only those SPR nozzles qualified to the requirements of SAE AS5877 are approved for use. Nozzles shall be equipped with 60-mesh or finer strainers. A quick disconnect sampling connection shall be provided on the nozzle for taking fuel samples and for pressure checks.

2. Over-wing nozzle (also referred to as "gravity" and "open-port") — nozzles shall meet the requirements of MIL-N-87963. Over-wing nozzles shall have a strainer of 60 mesh or finer and a tube spout suitable to the type of fuel and aircraft being serviced. Each over-the-wing nozzle shall have a permanently attached flexible bonding wire of suitable length terminating with a plug-type connector (a clamp-type connector may be used if it conforms to MIL-C-83413).

17.3 TACTICAL FUEL SYSTEMS/ EQUIPMENT

Tactical fuel systems, or forward operating base (FOB) support systems as they are also known, are collections of the refueling components described in paragraph 17.2 above. These systems are designed to be flexible and air, mobile, or ship transportable. FOB support systems, which are used primarily to support tactical operations in and around expeditionary airfields of varying sizes, are available in the following main types or categories:

1. Tactical Airfield Fuel Dispensing System (TAFDS)
2. Helicopter Expedient Refueling Systems (HERS)
3. M970 or Aviation Refueling Capability (ARC) mobile refueling vehicles.
4. Navy Advanced Base Functional Components Fueling Systems (H-14K)
5. SIXCON tank and pump modules.

These systems should not be used in place of a fixed facility at any Navy or Marine Corps Station unless a mission oriented training or operational necessity exists. For stations/bases where the requirement does exist, a lined concrete or steel containment berm is recommended (or as detailed by local environmental regulations). Where a continual requirement is identified for the use of a tactical system to augment refueling operations, a request for a fixed facility is encouraged.

Each refueling system; e.g., TAFDS, HERS, M970, and ARC, shall include the following minimum components:

1. Filter/Separator
2. Fuel quality monitor
3. Aircraft refueling nozzle — single point pressure refueling or over-wing nozzle
4. Sampling connection on the pressure refueling nozzle
5. Bonding/grounding cables.

17.3.1 Tactical Airfield Fuel Dispensing System (TAFDS). The TAFDS, as illustrated in Figure 17-1 is used to service expeditionary airfields within FOBs (less air points). It is made up of self-contained components that can be hooked together with quick-disconnect camlocking fittings to receive, store, transfer, and dispense aviation fuels. The design concept of the systems is to meet numerous operational requirements by permitting flexibility in assembly layouts. It is capable of receiving fuel from the Amphibious Assault Fuel System (AAFS) or other sources if appropriate adapters are available. TAFDS is designed to dispense fuel to up to 12 refueling points simultaneously. The basic capacity of the TAFDS is 320,000 gallons when configured with four 50,000-gallon and six 20,000-gallon collapsible tanks.

17.3.2 Helicopter Expedient Refueling System (HERS). The HERS, as depicted in Figure 17-2, is also composed of self-contained components that can be hooked together with quick-disconnect camlocking fittings to receive, store, transfer, and dispense aviation fuels. The HERS is designed for refueling helicopters at remote locations at the rate of 125 gallons per minute from 4 dispensing points. The HERS capacity is 18,000 gallons configured with three 3,000-gallon collapsible tanks and eighteen 500-gallon collapsible drums. The system may be tailored to increase or decrease capacity by adding or deleting tanks and accessories.

17.3.3 Navy Advanced Base Functional Components Fueling Systems (ABFC-H14K). An ABFC-H14K, which is illustrated in Figure 17-3, is a self-contained wheeled unit weighing approximately 6,000 pounds. It is designed to refuel aircraft at up to 350 gallons per minute. As outlined in Figure 17-4, each unit contains all of the components required to safely refuel aircraft, bottom load trucks, or transfer fuel from one tank or bladder to another. Basic unit configuration includes diesel driven fuel pump, filter/separator, fuel quality monitor, relaxation chamber, primary pressure control, deadman control, hose, hose reel, hose-end pressure regulator, and SPR refueling nozzle. Units are primarily designed to pump fuel from existing tanks or bladder systems; however, the cart's structure is designed to accommodate several collapsed bladders on top. Since these units possess all the requirements established for shore-based systems, ABFC-H14K operators shall follow the operating procedures and requirements contained in Chapter 12 of this manual.

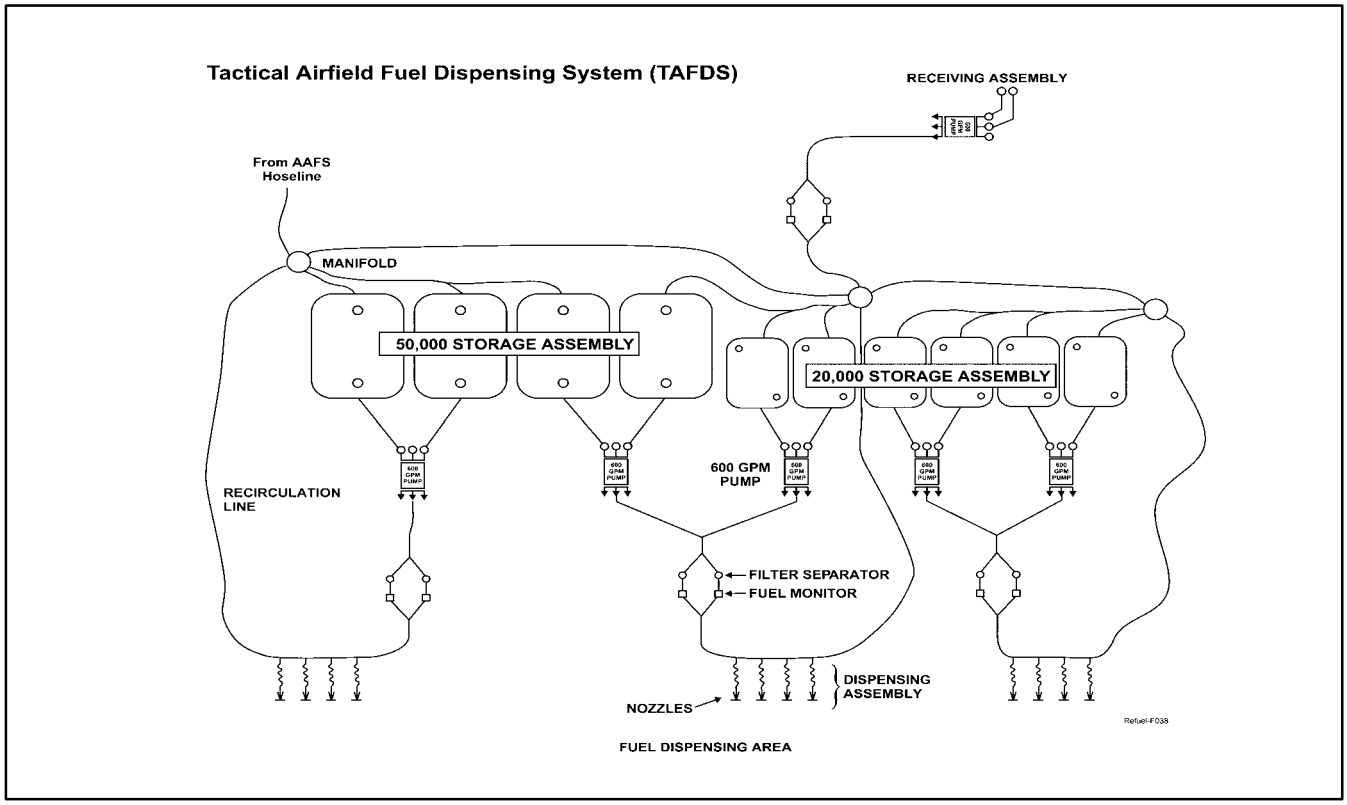


Figure 17-1. Tactical Airfield Fuel Dispensing System (TAFDS)

17.3.4 Mobile Aircraft Refuelers (M970/ARC). Mobile refuelers are used primarily for cold fueling operations. The Aviation Refueling Capability (ARCs) are not resident within the Marine Corps tactical refueling system at this time; however there is an ongoing effort to add these items.

Tactical refuelers shall meet the following minimum requirements:

1. Tank construction shall consist of one compartment only, with necessary baffles. Tank shall completely drain at low point without traps of liquid remaining in pockets. The tank shall be designed so that all portions are accessible for cleaning and maintenance.

2. Tanks shall be aluminum or stainless steel.

3. Tank top opening(s) shall be semipermanently secured with padlocks and opened for inventory purposes only, gauging prior to loading (field environment) and interior inspections and repairs. Manhole covers should incorporate a fusible plug or plugs, each equipped with fine screens to provide additional emergency vapor release.

4. Tank shall be configured for bottom loading.

5. The piping system including all hardware components shall be capable of dispensing fuel at rated flow.

CAUTION

The use of swing joints with Zerk grease fittings is prohibited, since they can contaminate the fuel with grease.

6. Aircraft fuel servicing vehicles shall have at least two fire extinguishers installed. Each extinguisher shall have an ANSI rating of not less that 20-B.

7. Tires shall be wide lug, wide groove tread. The tread shall not have narrow groove design in which small stones and foreign matter could become embedded and deposited on airfield surfaces. Recaps and slicks are not authorized for use on the front wheels when operating off-base.

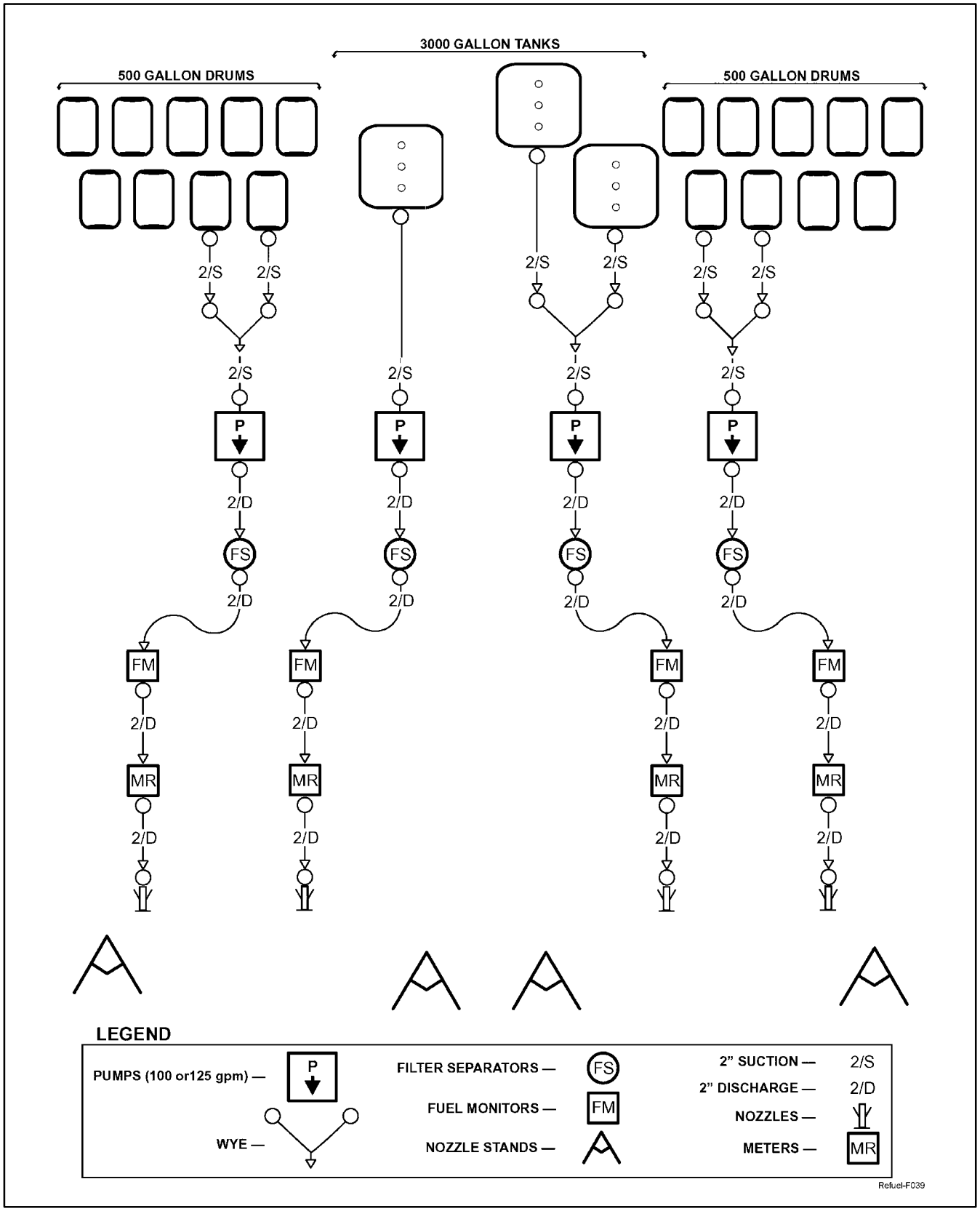


Figure 17-2. Helicopter Expedient Refueling System (HERS)

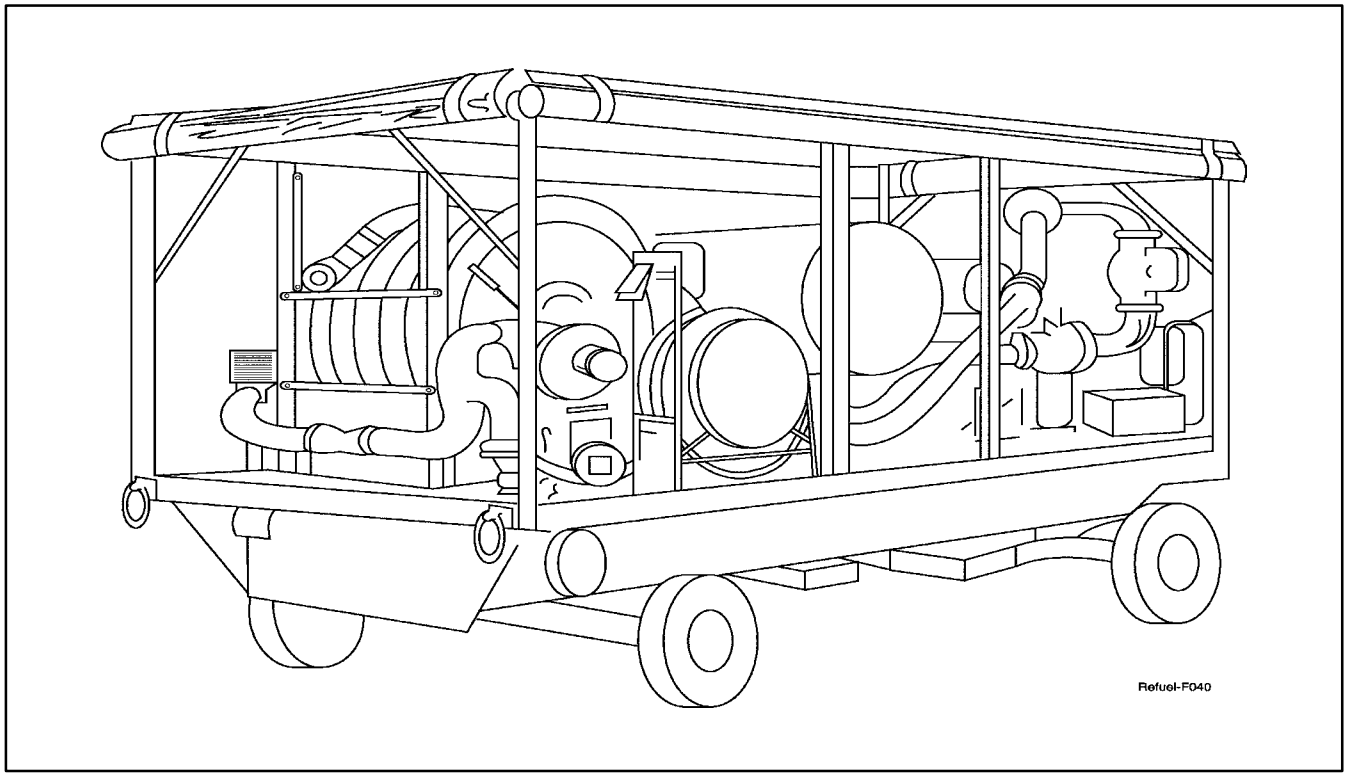


Figure 17-3. Navy Advanced Base Functional Components Fueling Systems (ABFC-H14K)

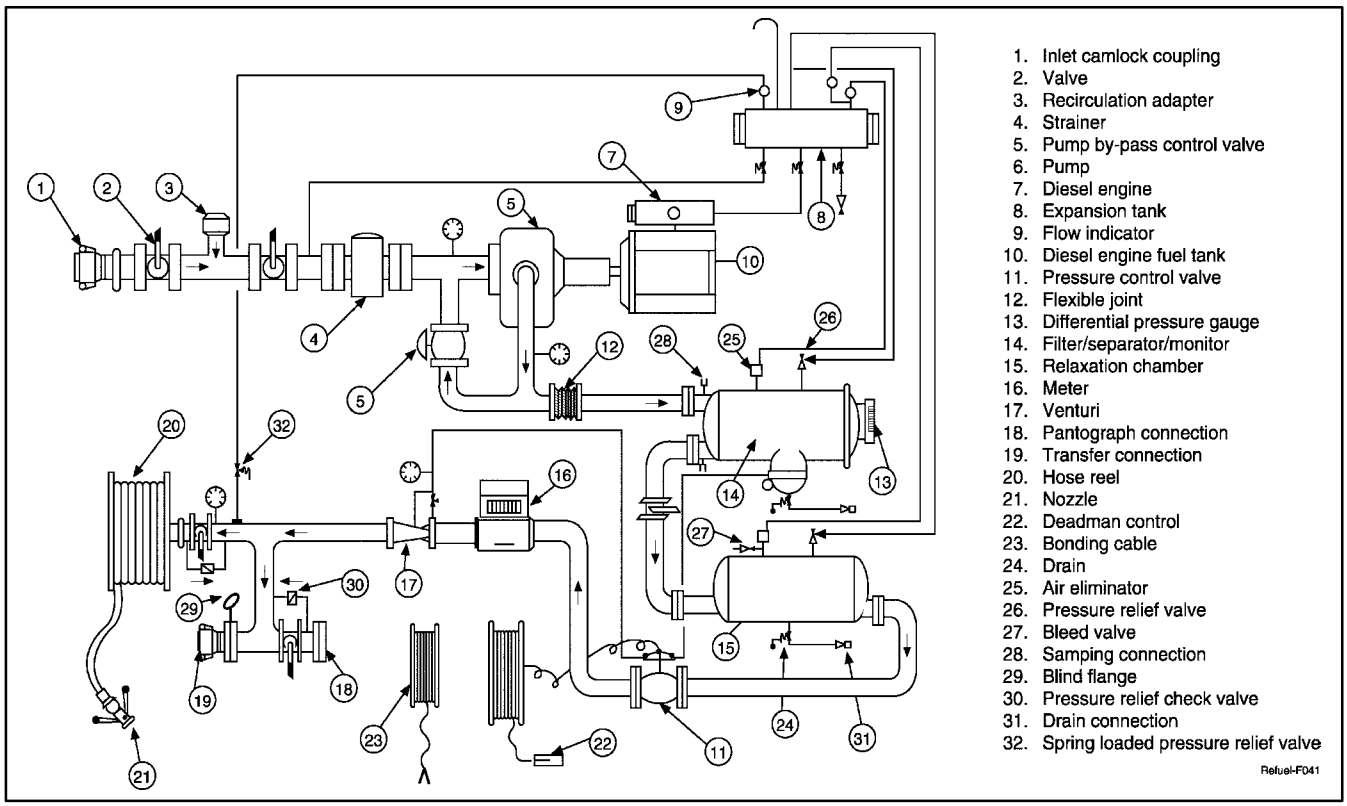


Figure 17-4. ABFC-H14K System Schematic

8. The exhaust of all engines, including auxiliary engines, shall be equipped with a suitable spark arrestor.
9. Filter/separator.
10. Fuel quality monitor.
11. Pressure and differential pressure gauges.
12. Meter.
13. Approved aircraft refueling hoses.
14. Dry break quick disconnect coupling.
15. Hose-end pressure regulator.
16. Approved aircraft refueling nozzles.

Note

Refueler/defuelers shall have two separate hoses — one that includes a hose end pressure regulator for refueling operations and one without for defueling operations.

17. Bonding cable(s).
18. Remote, hand-held deadman control.

For a more detailed discussion of the physical and functional descriptions of tactical fueling assets, refer to associated TMs, NAVAIRs, etc.

17.4 AIRCRAFT DEFUELING EQUIPMENT

17.4.1 Refuelers/Defuelers. The most ideal and cost-effective method of handling nonsuspect defueled aviation turbine fuel is to reissue it to an aircraft.

WARNING

The opening of manholes during defuel operation is prohibited.

In addition to the requirements for refuelers, refuelers/defuelers shall meet the following minimum requirements:

1. Refuel/defuel trucks shall carry the markings, "JET FUEL/JP" in place of the normal markings; e.g., "JP-5 JET FUEL F-44" or JP-4 JET FUEL F-40."
2. A dedicated defuel connection to piping system that passes the fuel through the pump, filter/separator, and fuel monitor before it enters the tank must be implemented.
3. Separate hose and nozzle assemblies shall be provided on refuel/defuelers for each of the two different operations — refueling and defueling.
4. Maximum defuel rate is 100 gpm.

17.4.2 Defuelers. These units are used for defueling ONLY. Fuel placed in a defueler shall not be directly reissued into an aircraft since the fuel carried is suspect. Fuel in a defueler shall be sampled and tested to determine disposition. Defuelers will be clearly marked as such.

17.5 TRUCK PARKING AREAS

17.5.1 Condition of Truck Parking Areas. Each unit shall have adequate truck parking areas accessible by good roads. Both the parking area(s) and the access roads shall be paved and maintained in good condition. Parking areas shall be free from chuck holes and ruts that cause refueler damage and FOD.

17.5.2 Parking Area Requirements. Refuelers/fuel servicing equipment shall be parked in designated parking areas. Equipment shall be positioned so that it is free to exit its designated parking areas without requiring excessive backing or abnormal maneuvering to avoid structures such as buildings, hose lines, other vehicles, or other equipment. Units shall have sufficient truck parking spaces to allow:

1. A minimum lateral separation of 25 feet (measured center to center of truck) between trucks.
2. No trucks to be parked closer than 100 feet to any inhabited structure.
3. Separate entry/exit designed to facilitate one-way traffic patterns within the parking area.
4. Free and direct egress from the parking area of any truck at all times. No object or another truck may block or hinder the egress of any of the trucks parked in an area.

5. Security to preclude unauthorized unintended entry into the refueler parking area

6. Security lighting (optional in a field environment)

7. Spill containment that will prevent the run-off of fuel in the event of tank rupture or major spill during loading operations. The type of containment used depends on the scenario (in a nonfield environment, concrete is preferred over asphalt).

Note

Ramps over containment curbs should not be any more than 2-percent grades (2.4 inches in 10 feet) in order to avoid refueler damage.

17.6 RECEIVING SITES

Fuel can be received by pipeline, barge, railroad tank car, tank truck, or any combination thereof. Receiving stations are tailored to the method, quantities, and rates of fuel delivery. The primary method of aviation fuel delivery to the (TAFDS) is by hose line (pipeline) from the AAFS, truck, and in some instances, railroad tank car. Aviation fuel at this point should be received through a filter/separator or other appropriate filtration device. This is an essential requirement when fuel is received directly into the system charged with actual refueling of the aircraft. Communication equipment, if required, should be on-site during fuel-handling operations. Appropriate environmental protection shall be provided.

17.7 STORAGE TANKS

All collapsible tanks employed in the refueling of aircraft will be in accordance with appropriate Military Specifications. Tanks shall be maintained as aviation fuel (turbine fuels) only. Tanks previously used for ground fuels (e.g., diesel, Mogas, etc.) shall not be used for aviation fuels.

CHAPTER 18

Operating Procedures for Tactical Fuel Units

18.1 INTRODUCTION

This chapter establishes minimum operating procedures to assure safe handling of aviation fuel. The operating procedures presented and discussed in this chapter are for systems/assets common to FMF units engaged in the fueling of aircraft. They include the basic steps that, for safety reasons, shall be performed with each fuel handling operation with particular emphasis on the fueling of aircraft. Any departure from the procedures of this chapter may adversely affect the overall safety of the operation being performed.

WARNING

Refueling personnel shall discontinue any fuel operation that does not appear to be progressing in a normal fashion (e.g., appears to be taking much longer than would normally be expected, or pressures are too high, etc.) or when a safety violation is in evidence and shall immediately notify the FO. Failure to recognize and terminate such an operation could lead to a catastrophic accident.

No deviation shall be made from the procedures contained in this chapter without the full cognizance of the FO. In those situations where abnormal fuel operations are required, the FO will determine whether or not to proceed with the proposed action. Assistance is available to the FO in accomplishing this task from NAVFAC (Code 00CE3), NAVAIR (Code AIR-4.4.5), NAVPETOFF (Code 40), and/or TYCOMs (Code 44).

18.2 GENERAL OPERATING PROCEDURES

Fuel delivery equipment shall be operated by qualified fuel personnel and shall not be subcustodied to other than qualified fuels organizations. The following procedures are general in nature and shall be applied to all operations performed by each unit engaged in the fueling of aircraft.

Note

Forward Arming and Refueling Point (FARP) operations dictate that actual arming/refueling operations are conducted in close proximity. However, simultaneous arming and refueling operations are not authorized. Hot/cold refueling procedures outlined in this chapter shall be followed.

18.2.1 Spill Prevention and Control. Proper training of fuel servicing personnel is essential. Proper maintenance of the equipment is equally essential. Leaking or malfunctioning equipment shall be removed from service. Self-closing nozzles or deadman controls (where provided) shall not be blocked open or bypassed. Kinks and short loops in fuel hoses shall be avoided. In addition, a fuel spill/fire prevention drill must be conducted at least quarterly in accordance with NAVSUP P-558.

When a spill is observed, the fuel servicing shall be stopped immediately by release of the deadman control, by closing the nozzle handle, or by operation of the emergency fuel shut-off. The supervisor shall be notified at once and the operation shall not be resumed until authorized by the supervisor. Every fuel spill shall be investigated to determine the cause, whether emergency procedures were properly carried out and what corrective measures are required.

18.2.1.1 Priming Spills. Pint-size spills, involving an area less than 18 inches in any dimension, require no emergency action during cold refueling operations; however, applicable personnel shall stand-by with a fire extinguisher until operations are complete and/or the aircraft departs. A spill or leak of any size is cause for terminating a hot refueling operation.

18.2.1.2 Small Spills. Other small spills involving an area of from 18 inches to 10 feet in any dimension shall have a fire guard posted, equipped with at least 1 fire extinguisher. Either absorbent cleaning agents (such as diatomaceous earth) or emulsion compound may be used to absorb the spilled fuel. Contaminated absorbent materials shall be placed in metal containers with closed lids until they can be removed and disposed of in accordance with local hazardous waste disposal procedures.

CAUTION

Fuel contact can adversely affect some types of surfaces (e.g., asphalt).

18.2.1.3 Large Spills. Covering an area greater than 10 feet in any dimension or over 50 square feet in area, requires handling by a supporting Spill Response Team. The team shall be summoned immediately and all other personnel evacuated to a safe distance. No one shall be permitted to walk through the liquid area of a fuel spill.

Note

The above spill size designators and corrective measures are general. Local regulations may be more stringent.

18.2.1.4 Spill Response. All fuel spills shall be reported immediately to the activity's Environmental Coordinator in accordance with the local spill contingency plan.

Note

- All fuel handling personnel shall be familiar with the local spill contingency plan.
- All FOs should be thoroughly familiar with OPNAVINST 5090.1.

18.2.2 Surge Pressure Control. All fuel handling procedures shall be designed to minimize surge pressure to below 120 psi. The following actions will help to accomplish this:

1. Close all valves slowly, particularly during the last half of the closure.

WARNING

Even during an emergency such as a hose or pipeline leak, valves shall be closed slowly. Rapid closing of a valve can create a surge pressure of sufficient magnitude to rupture hoses or equipment.

2. Pressure gauges installed in equipment must remain operational so operators can keep pressures within limits as valves are closed.
3. Start and stop pumps with recirculation lines opened, if there is such a perversion, then slowly close the lines.
4. In starting an operation, open the downstream valve first and work toward the pumping source.
5. In stopping an operation, reverse the above and close the upstream valve first.

18.3 REFUELING AIRCRAFT AT STATIONARY SYSTEMS (TAFDS AND HERS) WITH ENGINES OFF (COLD REFUELING)

Each unit shall record its direct refueling operations with a log similar to Figure 12-1.

18.3.1 Pressure Refueling

18.3.1.1 Personnel Requirements. Cold refueling aircraft (static conditions) require a minimum of three people:

1. Nozzle operator/plane captain. He/she shall be fully qualified for aircraft refueling operations duties related to the specific type/model aircraft being refueled. (See paragraph 14.2.3.) The Airfield Operations Officer will coordinate with tenant squadrons to provide nozzle operators for transient aircraft.
2. Refueling point operator. He/she shall be a fully qualified refueling point operator from the fuels unit. Duties shall include zeroing the meter, chocking the aircraft, grounding the aircraft, assisting the nozzle operator in nozzle hook-up, acting as fire watch, and completing necessary paper work.

3. Pump operator. He/she shall be a fully qualified refueling point operator from the fuels unit. Duties include controlling the speed of the pump and thereby the system's fuel pressure.

18.3.1.2 Procedures. Aircraft refueling tasks are to be performed in the following sequence and verified by the pump operator or the refueling point operator:

1. Recirculate (flush) the system hoses and take a fuel sample for quality-control checks as appropriate. (refueling point operator)

WARNING

Fuel shall be recirculated/flushed through the refueling hose and nozzle, and tested for contamination prior to refueling the first aircraft each day. Fueling shall not begin until acceptable results have been obtained (see Chapter 15). Failure to provide clean, dry fuel to aircraft can adversely affect safety-of-flight.

2. Check for hot brake conditions. (nozzle operator/plane captain)

Note

Hot brake check is applicable to fixed-wing aircraft only.

3. Position aircraft and chock it. (nozzle operator/plane captain)

Note

- If an aircraft is towed into the refueling area during operation of the fueling system, the tow tractor shall remain attached to the aircraft and manned. This allows egress of the aircraft if an emergency situation arises.

- Aircraft can taxi in and shut down, then cold refuel in accordance with these overwing procedures. Refueling operations at adjacent refueling points shall be suspended during engine shutdown and startup.

4. Pilot (or plane captain) shall secure all unnecessary electronic and electrical equipment not required for refueling.

WARNING

Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until evolution has been completed or refueling has been stopped for an emergency (e.g., NO aircraft engines or APU shall be started or stopped and external power shall NOT be connected, disconnected, or switched on/off). Changing the aircraft's electrical power status can create significant ignition sources.

5. Verify that firefighting equipment is in the immediate vicinity of the refueling operation. (Refueling point operator)

6. Attach a grounding cable from the aircraft to an established earth ground. (nozzle operator/plane captain)

7. Zero the fueling system's meter or note the existing reading. (refueling point operator)

8. Pull out the refueling hose and place in proper position for refueling. (nozzle operator and refueling point operator)

9. Remove refueling adapter cap from the aircraft and the dust cover from the nozzle. Inspect the face of the nozzle to ensure it is clean, and verify that the flow control handle is in the fully closed and locked position. (nozzle operator/plane captain)

10. Visually inspect the aircraft's adapter (receptacle) for any damage or significant wear. If any doubt about the integrity of the adapter exists, do not refuel.

WARNING

A worn or broken adapter can defeat the safety interlocks of the refueling nozzle permitting the poppet valve to open and fuel to spray or spill.

11. Lift nozzle by lifting handles, align the lugs with the slots on the aircraft adapter and hook up to the aircraft by pressing the nozzle firmly onto the adapter and rotating clockwise to a positive stop. (nozzle operator)

WARNING

Nozzle must seat firmly on the adapter and not be cocked. Cocking can indicate a malfunction of the nozzle's safety interlock system which can lead to a fuel spray or spill.

12. Upon receiving signals from nozzle operator/ plane captain that hook-up has been completed and fueling operation is ready to begin, the refueling point operator will signal the pump operator to charge the system allowing fuel to flow to the nozzle.

13. When hose is fully charged, rotate the nozzle flow control handle to the FULL OPEN position. The handle shall rotate 180 degrees to ensure that the poppet valve is fully open and locked. (nozzle operator)

WARNING

The flow control handle of the single point pressure refueling nozzle shall be placed in either of two locked positions — fully open or fully closed. The handle is NOT to be used as a flag to indicate fuel flow. Excessive wear on the aircraft's adapter and the fuel nozzle poppet will result if the handle is allowed to float in the unlocked position.

14. Once fuel flow has been established, exercise the aircraft's precheck system. (plain captain/nozzle operator)

Note

- The precheck system simulates conclusion of a complete refueling by closing all of the tank inlet shut-off valves within the aircraft. All fuel flow into the aircraft should stop within a few seconds to 1 minute of actuating the precheck system. The refueling meter is the primary means of detecting that fuel flow has stopped and precheck was successful. If a meter is not available, successful precheck can be confirmed by observing the jerk and stiffening that occur in the refueling hose and/or the pressure spike that occurs at the pump's discharge pressure gauge.

- Aircraft may be cold refueled if it fails precheck, but special procedures are required. This should be done only as an operational necessity. Refer to appropriate aircraft NATOPS Manual.

15. Fuel aircraft as directed by nozzle operator/plane captain. Nozzle operator/plane captain shall monitor aircraft vents, tank pressure gauge(s) and/or warning lights as necessary. (nozzle operator)

16. When directed by the nozzle operator/plane captain, stop the flow of fuel. (Use deadman control if so equipped.) (refueling point operator)

17. Rotate the nozzle flow control handle into the OFF and fully locked position. (nozzle operator and verified by the refueling point operator)

WARNING

Failure to lock the flow control handle in the OFF position can contribute to a failure of the nozzle's safety interlock system and could result in a fuel spray or spill.

18. Disconnect nozzle from the aircraft adapter. (nozzle operator)

19. Disconnect the nozzle bonding plug/clip from the aircraft. (nozzle operator)

20. Disconnect the earth ground from the aircraft and stow away to its proper position. (nozzle operator and refueling point operator)

21. Stow the hose and return the nozzle to its proper position. (nozzle operator and refueling point operator)

22. Complete paperwork. (nozzle and refueling point operator)

18.3.2 Over-Wing/Open-Port (Gravity Refueling)

18.3.2.1 Personnel Requirements. Cold over-wing gravity refueling of aircraft (static conditions) requires a minimum of three people — a nozzle operator (see paragraph 14.2.3), a refueling point operator and a pump operator. The refueling point operator will man the fire extinguisher during this operation. The Airfield Operations Officer will coordinate with tenant squadrons to provide nozzle operators for transient aircraft.

WARNING

Over-wing refueling with the aircraft's engines operating is NOT authorized.

18.3.2.2 Procedures. Aircraft refueling tasks are to be performed in the following sequence and verified by the refueling point operator:

1. Recirculate (flush) the system hoses and take a fuel sample for quality-control checks as appropriate. (refueling point operator or pump operator)

WARNING

Fuel shall be recirculated/flushed through the refueling hose and nozzle, and tested for contamination prior to refueling the first aircraft each day. Fueling shall not begin until acceptable results have been obtained. (See Chapter 15.) Failure to provide clean, dry fuel to aircraft can adversely affect safety-of-flight.

Note

Recirculate the refueling system and take samples with the SPR nozzle in place, then replace the SPR with over-wing nozzle immediately before commencing open-port refueling operations.

2. Check for hot brake conditions. (nozzle operator/plane captain)

Note

Hot brake check is applicable to fixed-wing aircraft only.

3. Position aircraft and chock it. (nozzle operator/plane captain)

Note

- If an aircraft is towed into the refueling area during operation of the fueling system, the tow tractor shall remain attached to the aircraft and manned. This allows egress of the aircraft if an emergency situation arises.

- Aircraft can taxi in and shut down, then cold refuel in accordance with these overwing procedures. Refueling operations at adjacent refueling points shall be suspended during engine shutdown and startup.

4. Pilot (or plane captain) shall secure all unnecessary electronic and electrical equipment not required for refueling.

5. Verify that firefighting equipment is in the immediate vicinity of the refueling operation and manned. (refueling point operator)

6. Attach a grounding cable from the aircraft to an established earth ground. (nozzle operator/plane captain)

7. Zero the refueling system's meter or note the existing reading. (refueling system operator)

8. Pull out the refueling hose and place in proper position for refueling. (nozzle operator and refueling system operator)

9. Bond the over-wing nozzle to the aircraft. (nozzle operator)

WARNING

Always bond the nozzle to the aircraft before the fill cap is removed. This connection shall remain in place until the entire fueling operation is complete. Failure to bond nozzle and/or maintain contact can result in a dangerous static spark inside the fuel tank.

10. Remove refueling cap from the aircraft and the dust cover from the nozzle. (nozzle operator)

11. Insert over-wing nozzle into the aircraft's refueling port and maintain metal-to-metal contact between the over-wing nozzle and the aircraft's refueling port throughout the entire fueling operation. (nozzle operator)

12. Upon receiving signals from nozzle operator/plane captain that hook-up has been completed and fueling operation is ready to begin, refueling point operator signals the pump operator to charge the system allowing fuel to flow to the nozzle.

13. Nozzle operator shall squeeze the handle on the over-wing nozzle to initiate fuel flow and fuel aircraft as directed by nozzle operator/plane captain. Nozzle operator/plane captain shall monitor aircraft vents, tank pressure gauge(s) and/or warning lights as necessary.

14. When directed by the nozzle operator/plane captain, stop the flow of fuel. (refueling point operator)

15. Remove the nozzle from the aircraft. (nozzle operator)

16. Disconnect nozzle bonding plug/clip from the aircraft. (nozzle operator)

17. Disconnect bonding cable from the aircraft and the fuel monitor.

18. Disconnect earth ground from the aircraft and stow away to its proper position. (nozzle operator and refueling point operator)

19. Stow the hose and return the nozzle to its proper position. (nozzle operator and refueling point operator)

20. Complete paperwork. (nozzle and refueling point operator)

18.4 TRUCK OPERATIONS

18.4.1 Filling Mobile Refueling Equipment (e.g., Rigid Tanks)

18.4.1.1 Personnel Requirements. Filling of mobile refueling equipment from TAFDS or HERS is a two-man operation for equipment not having high-level alarms/shut-off control features. The vehicle operator acts in the capacity of a nozzle operator. The second person will be the refueling point operator. His duties include pump operation and recirculation.

WARNING

Top loading shall not be performed. This method of filling rigid tanks is extremely dangerous because of the highly flammable vapors and static charges produced.

18.4.1.2 Procedures. Applicable equipment shall be filled in the following sequence:

1. Recirculate (flush) the system hoses and take a fuel sample for quality control checks as appropriate. (refueling point operator)

WARNING

Fuel shall be recirculated/flushed through the refueling hose and nozzle, and tested for contamination prior to issuing fuel each day. Fueling shall not begin until acceptable results have been obtained. (See Chapter 15.) Failure to provide clean, dry fuel can adversely affect safety-of-flight.

2. Position vehicle, turn off lights, place gear shift in neutral/park position, set parking brake, stop engine, and turn off all switches (except for necessary alarms, etc.). (vehicle operator)

3. Verify that firefighting equipment is in the immediate vicinity of the loading operation. (refueling point operator)

4. Verify product and estimate the amount of product to be loaded. (vehicle operator)

5. Attach a grounding cable from the vehicle to an established earth ground. (nozzle operator)

6. Zero the refueling system's meter or note the existing reading. (refueling point operator)

7. Pull out the loading/refueling hose and place in proper position for loading. (nozzle operator and refueling point operator)

8. Attach bonding cable between the fuel monitor and the tank to be loaded. (nozzle operator)

9. Remove loading receptacle cap from the tank/truck. (nozzle operator)

10. Visually inspect the tank/truck adapter (receptacle) for any damage or significant wear. If any doubt about the integrity of the adapter exists, do not refuel. (nozzle operator)

WARNING

A worn or broken adapter can defeat the safety interlocks of the SPR refueling nozzle permitting the poppet valve to open and fuel to spray or spill.

11. Remove the nozzle dust cover from the nozzle and inspect the face of the nozzle to ensure it is clean and verify that the flow control handle is in the fully closed and locked position. (nozzle operator)

12. Lift nozzle by lifting handles, align the lugs with the slots on the tank/truck adapter, and hook up to the tank/truck by pressing it firmly onto the adapter and rotating clockwise to a positive stop. (nozzle operator)

WARNING

Nozzle must seat firmly on the adapter and not be cocked. Cocking can indicate a malfunction of the nozzle's safety interlock system that can lead to a fuel spray or spill.

13. Upon receiving signals from vehicle operator that hook-up has been completed and fueling operation is ready to begin, refueling point operator charges the system allowing fuel to flow to the nozzle.

14. Rotate the nozzle flow control handle to the FULL OPEN position. The handle should rotate 180 degrees to ensure that the poppet valve is fully open and locked. (nozzle operator)

CAUTION

The flow control handle of the single point pressure refueling nozzle shall be placed in either of two locked positions — fully open or fully closed. The handle is NOT to be used as a flag to indicate fuel flow. Excessive wear on the tank/truck adapter and the fuel nozzle poppet will result if the handle is allowed to float in the unlocked position.

15. Start filling operation slowly. (nozzle operator and refueling point operator)

CAUTION

Trucks that have been completely drained shall be minimally filled at a slow flow rate in order to cover the bottom inlet valve inside the tank prior to providing increased flow rates.

16. Monitor the meter throughout the loading evolution until the desired amount is dispensed into the truck/tank. (refueling point operator)

WARNING

Personnel should not be on top of the tank/truck during the loading operation. Tanks being filled should be monitored via the meter during the filling process. Secure pumping if the meter exceeds the amount required for the tank. DO NOT OVERFILL.

17. When directed by the vehicle operator, stop the fuel flow. (refueling point operator)

18. Rotate the nozzle flow control handle into the OFF and fully locked position. (nozzle operator and verified by the refueling point operator)

WARNING

Failure to lock the flow control handle in the OFF position can contribute to a failure of the nozzle's safety interlock system and could result in a fuel spray or spill.

19. Disconnect nozzle from the tank/truck adapter. (nozzle operator)

20. Disconnect the bonding cable from the tank/truck. (nozzle operator)

21. Disconnect the earth ground from the tank/truck and stow away to its proper position. (vehicle operator and refueling point operator)

22. Stow the hose and return the nozzle to its proper position. (nozzle operator and refueling point operator)

23. Complete paperwork. (vehicle and refueling point operator)

24. Inspect the tank/truck for leaks. (vehicle operator)

25. Remove refueler from the loading area. (vehicle operator)

18.4.2 Cold Refueling Aircraft with Mobile Refuelers. Units shall dispatch their mobile refuelers (i.e., M970) and record their movements and operations utilizing Form NAVMC 10031 (Daily Dispatch Record of Vehicles) and Form NAVMC 10627 (Vehicle and Equipment Operational Record).

18.4.2.1 Positioning of Refueler. Positioning of refuelers to service aircraft shall be performed in the same manner without variation so all personnel involved know exactly what to expect. Whenever possible, refuelers shall proceed down a line of parked aircraft with the driving path perpendicular to the aircraft fuselage access, at the maximum distance hose length will permit servicing; however, at no time shall a truck approach closer than 10 feet of an aircraft. This normal refueler approach path, which is illustrated in Figure 12-6, is applicable to all fixed-wing tactical aircraft and helicopters. Normally, no turns are made except at the end of the parking line. Driving between aircraft parked in line must be avoided; however, the preferred approach is not always possible. Figure 12-7 shows acceptable alternate methods when aircraft are not parked in line or hose lengths are insufficient for service. Figure 12-8 shows the safe approach paths to prop, prop/jet and transport aircraft, while Figure 12-9 illustrates the alternate approach paths for helicopters.

Refuelers shall NEVER:

1. Be left pointing toward any part of an aircraft.

2. Be driven in the area described by straight line projections connecting points 10 feet from an aircraft's extremities. (See Figures 12-7, 12-8, and 12-9.)

3. Be backed in proximity to aircraft.

The refueler shall be parked in a position on the same side of the aircraft as the aircraft's adapter so that the vehicle operator has a direct line of sight to the

refueling nozzle operator while actuating the deadman control. (M970)

WARNING

- Failure of the vehicle operator to visually observe the nozzle operator throughout the refueling operation can lead to a fuel spill or fire.
- The hose shall not pass underneath the aircraft's fuselage to reach the SPR receptacle.

Note

Tailpipe temperature and the location of aircraft tank vents are important considerations when determining alternate routes and fueling positions.

18.4.2.2 Refueler Preparation. Prepare refueler for operations as follows:

1. Recirculate (flush) the lines/hoses and take fuel sample for quality-control checks as appropriate. (refueler operator)

WARNING

Fuel shall be recirculated/flushed through the refueling hose and nozzle, and tested for contamination prior to issuing fuel each day. Fueling shall not begin until acceptable results have been obtained. (See Chapter 15.) Failure to provide clean, dry fuel can adversely affect safety-of-flight.

Note

Operators may recirculate the refueling system and take samples with the SPR nozzle in place, then replace the SPR with over-wing nozzle immediately before commencing refueling operations if open-port refueling is required.

2. Drive refueler into position for refueling following approach paths discussed above. Refuelers shall be positioned so it can be driven away quickly in an emergency. No wheel chocks shall be used. (vehicle operator)
3. Set brakes. (vehicle operator)
4. Place gear shift in neutral. (vehicle operator)
5. Turn off headlights and unnecessary switches. (vehicle operator)
6. Open driver's side door. It shall remain partially open during the entire refueling operation. (vehicle operator)
7. Attach a grounding cable from the vehicle to an established earth ground. (nozzle operator and vehicle operator)

18.4.2.3 Pressure Refueling

18.4.2.3.1 Personnel Requirements. Refueling aircraft with mobile refuelers is a two-person function requiring a nozzle operator (see paragraph 14.2.3) and a vehicle operator. The nozzle operator shall assist the vehicle operator in removing and replacing the hose on the refueler. The Airfield Operations Officer will coordinate with tenant squadrons to provide nozzle operators for transient aircraft.

18.4.2.3.2 Procedures. When refueler is in position and prepared as above, conduct refueling operations as follows:

1. Check for hot brake conditions. (nozzle operator/plane captain)

Note

Hot brake check is applicable to fixed-wing aircraft only.

2. Pilot (or plane captain) shall secure all unnecessary electronic and electrical equipment not required for refueling.

WARNING

Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until evolution has been completed or refueling has been stopped for an emergency (e.g., NO aircraft engines or APU shall be started or stopped and external power shall NOT be connected, disconnected, or switched on/off). Changing the aircraft's electrical power status can create significant ignition sources.

3. Verify that firefighting equipment is in the immediate vicinity of the refueling operation and manned by supported squadron personnel. (vehicle operator)

4. Attach a grounding cable from the aircraft to an established earth ground. (nozzle operator/plane captain)

5. Zero the fueling system's meter or note the existing reading. (vehicle operator)

6. Pull out the refueling hose and place in proper position for refueling. (nozzle operator and refueling point operator)

7. Attach bonding cable between the refueler and the aircraft. (plane captain/nozzle operator)

8. Remove refueling adapter cap from the aircraft and the dust cover from the nozzle. Inspect the face of the nozzle to ensure it is clean and verify that the flow control handle is in the fully closed and locked position. (nozzle operator/plane captain)

9. Visually inspect the aircraft's adapter (receptacle) for any damage or significant wear. If any doubt about the integrity of the adapter exists, do not refuel.

WARNING

A worn or broken adapter can defeat the safety interlocks of the refueling nozzle, permitting the poppet valve to open and fuel to spray or spill.

10. Lift nozzle by lifting handles, align the lugs with the slots on the aircraft adapter and hook up to the aircraft by pressing it firmly onto the adapter and rotating clockwise to a positive stop. (nozzle operator)

WARNING

Nozzle must seat firmly on the adapter and not be cocked. Cocking can indicate a malfunction of the nozzle's safety interlock system that can lead to a fuel spray or spill.

11. Upon receiving signals from nozzle operator/plane captain that hook-up has been completed and fueling operation is ready to begin, refueling point operator charges the system, allowing fuel to flow to the nozzle.

WARNING

Deadman controls shall not be blocked open or otherwise inhibited (i.e., M970). This defeats the purpose of the device and can lead to a catastrophic accident.

12. When hose is fully charged, rotate the nozzle flow control handle to the FULL OPEN position. The handle shall rotate 180 degrees to ensure that the poppet valve is fully open and locked. (nozzle operator)

WARNING

The flow control handle of the single point pressure refueling nozzle shall be placed in either of two locked positions — fully open or fully closed. The handle is NOT to be used as a flag to indicate fuel flow. Excessive wear on the aircraft's adapter and the fuel nozzle poppet will result if the handle is allowed to float in the unlocked position.

13. Once fuel flow has been established, exercise the aircraft's precheck system. (plane captain)

Note

- The precheck system simulates the completion of a complete refueling by

closing all of the tank inlet shut-off valves within the aircraft. All fuel flow into the aircraft should stop within a few seconds to 1 minute of actuating the precheck system. The refueling meter is the primary means of detecting that fuel flow has stopped and precheck was successful. If a meter is not available, successful precheck can be confirmed by observing the jerk and stiffening that occurs in the refueling hose and/or the pressure spike that occurs at the truck's pump discharge pressure gauge.

- Aircraft may be cold refueled if it fails precheck, but special procedures are required. This should be done only as an operational necessity. Refer to appropriate aircraft NATOPS Manual.

14. Fuel aircraft as directed by nozzle operator/plane captain. Nozzle operator/plane captain shall monitor aircraft vents, tank pressure gauge(s) and/or warning lights as necessary.

15. When directed by the nozzle operator/plane captain, stop the flow of fuel using the deadman control. (refueling point operator)

16. Rotate the nozzle flow control handle into the OFF and fully locked position. (nozzle operator and verified by the refueling point operator)

WARNING

Failure to lock the flow control handle in the OFF position can contribute to a failure of the nozzle's safety interlock system and could result in a fuel spray or spill.

17. Disconnect nozzle from the aircraft adapter. (nozzle operator)

18. Disconnect the bonding cable from the aircraft and stow away. (nozzle operator)

19. Disconnect the earth ground from the aircraft and stow away to its proper position. (nozzle operator and refueling point operator)

20. Stow the hose and return the nozzle to its proper position. (nozzle operator and refueling point operator)

21. Complete paperwork. (nozzle and refueling point operator)

18.4.2.4 Over-Wing/Open-Port Refueling

18.4.2.4.1 Personnel Requirements. Over-wing refueling aircraft with mobile refuelers is a three-person function requiring a nozzle operator (see paragraph 14.2.3), a vehicle operator, and a fire-extinguisher operator. The nozzle operator shall assist the vehicle operator in removing and replacing the hose on the refueler. The Airfield Operations Officer will coordinate with tenant squadrons to provide fire extinguisher and nozzle operators for transient aircraft.

18.4.2.4.2 Procedures. Once the refueler is in position and prepared as stated in paragraphs 18.4.2.1 and 18.4.2.2, conduct fueling operations as follows:

WARNING

Over-wing refueling with the aircraft's engines operating is NOT authorized.

1. Check for hot brake conditions. (nozzle operator/plane captain)

Note

Hot brake check is applicable to fixed-wing aircraft only.

2. Pilot (or plane captain) shall secure all unnecessary electronic and electrical equipment not required for refueling.

3. Verify that firefighting equipment is in the immediate vicinity of the refueling operation and manned. (vehicle operator)

4. Attach a grounding cable from the aircraft to an established earth ground. (nozzle operator/plane captain)

5. Attach bonding cable between the refueling vehicle and the aircraft. (vehicle operator)

6. Zero the refueling system's meter or note the existing reading. (vehicle operator)

7. Pull out the refueling hose and place in proper position for refueling. (nozzle operator and vehicle operator)

8. Bond the over-wing nozzle to the aircraft. (nozzle operator)

WARNING

Always bond the nozzle to the aircraft before the fill cap is removed. This connection shall remain in place until the entire fueling operation is complete. Failure to bond nozzle and/or maintain contact can result in a dangerous static spark inside the fuel tank.

9. Remove refueling cap from the aircraft and the dust cover from the nozzle. (nozzle operator)

10. Insert over-wing nozzle into the aircraft's refueling port and maintain metal-to-metal contact between the over-wing nozzle and the aircraft's refueling port throughout the entire fueling operation. (nozzle operator)

11. Upon receiving signals from nozzle operator/plane captain that hook-up has been completed and fueling operation is ready to begin, refueling point operator charges the system allowing fuel to flow to the nozzle.

WARNING

Deadman controls shall not be blocked open or otherwise inhibited (i.e., M970). This defeats the purpose of the device and can lead to a catastrophic accident.

12. Nozzle operator shall squeeze the handle on the over-wing nozzle to initiate fuel flow and fuel aircraft as directed by nozzle operator/plane captain. Nozzle operator/plane captain shall monitor aircraft vents, tank pressure gauge(s) and/or warning lights as necessary.

13. When directed by the nozzle operator/plane captain, stop the flow of fuel (use deadman control if so equipped). (refueling point operator)

14. Remove the nozzle from the aircraft. (nozzle operator)

15. Disconnect bonding cable from the aircraft and stow it away. (nozzle operator)

16. Disconnect earth ground from the aircraft and stow away to its proper position. (nozzle operator and refueling point operator)

17. Stow the hose and return the nozzle to its proper position. (nozzle operator and refueling point operator)

18. Complete paperwork. (nozzle and refueling point operator)

18.4.3 Refueler Parking. All refueling vehicles shall be constantly attended whenever the engine is operating. Operator is considered in attendance when performing tasks directly associated with fueling an aircraft; e.g., assisting aircraft refueling operator, transporting hose, etc. If for any reason the operator leaves the truck unattended, he/she shall first:

1. Drive truck clear of aircraft.

2. Place air brake in the ON and LOCKED position, if applicable.

3. Set parking brakes.

4. Direct front wheels to an open unobstructed area.

5. Stop engine.

6. Chock the drive wheels.

18.5 FUELING WITH ENGINES OPERATING (HOT REFUELING)

Hot refueling shall be performed only when operational requirements dictate the need for rapid turnaround of aircraft since this operation is significantly more dangerous and costly — both in terms of fuel and manpower expenditures. Hot refueling shall be performed only with the SPR or CCR nozzles. Open-port hot refueling is not authorized.

18.5.1 Personnel Requirements. A minimum of four ground crew personnel are required for hot refueling aircraft. All personnel performing hot refueling operations shall be fully trained and qualified in accordance with Chapter 14 of this manual.

1. One pump operator/vehicle operator. He/she shall be a fully qualified operator from the local fuels organization. He/she shall be positioned at the pump/deadman control and maintain a clear line of sight with the refueling point operator and nozzle operator. Duties include actual operation of the deadman control (M970) or pump (TAFDS, HERS).

2. One nozzle operator. He/she shall be fully trained and certified for refueling duties related to the specific aircraft type/model being refueled. (See paragraph 14.2.3.) Duties shall include the performance of necessary aircraft refueling checks such as exercising the shut-off valves precheck system and vent and refueling panel monitoring. The nozzle operator shall remain at the nozzle throughout the refueling and leave only to conduct necessary vent checks. The Airfield Operations Officer will coordinate with tenant squadrons to provide fire extinguisher and nozzle operators for transient aircraft.

3. Refueling point operator. His/her duties include zeroing out the meter, grounding aircraft, placing chocks, assist in nozzle hook-up, manning the fire extinguisher during actual refueling operations, and completion of paper work.

4. Line NCO. Duties include preoperational fuel system check and monitoring overall safety procedures while aircraft are in the pit area.

18.5.2 Equipment Requirements. The following equipment is the absolute minimum required to conduct hot refueling operations.

1. One fuel service system, such as a TAFDS, HERS, or a M970 (configured with external hoses, etc.). The system shall possess all of the required features listed in Chapter 17 (e.g., filter/separator, fuel monitor). Equipment shall be grounded (earthed) through a connection of 10,000 ohms or less resistance. The servicing system fuel supply tank(s) shall be located at least 150 feet from the refueling point.

2. Bonding cables attached to refueling nozzles that provides an overall resistance of 10,000 ohms or less.

WARNING

Large static producing equipment and the aircraft being refueled must be grounded to earth.

3. Aircraft wheel chocks. (provided by the supported squadron)

4. Sound-attenuating ear protectors, goggles, cranials, long sleeved shirts, and pants for each member. Personnel shall avoid wearing shoes that have nails or other metal devices on the soles, which can cause sparking.

5. A fire extinguisher at each refueling point (see NATOPS Aircraft Firefighting and Rescue Manual, NAVAIR 00-80R-14). Availability of assets will dictate extinguisher sizes actually emplaced, but every effort shall be made to provide for the required extinguishers from the host CFR Branch. At an absolute minimum, extinguishers provided by authorized equipment allowances shall be emplaced.

WARNING

All ground personnel involved in hot refueling operations shall be qualified in the operation of the extinguishing equipment in use.

18.5.3 Hot Refueling Procedures

18.5.3.1 Initial Hot Refueling Procedures Prior to Entering the Refueling Area. The following steps shall be accomplished prior to entering the hot refueling area.

1. Recirculate (flush) the system or mobile refueler's hoses and take a fuel sample for quality

control checks as appropriate. (refueling point operator)

WARNING

- Fuel shall be recirculated/flushed through the refueling hose and nozzle, and tested for contamination prior to issuing fuel each day. Fueling shall not begin until acceptable results have been obtained (see Chapter 15). Failure to provide clean, dry fuel can adversely affect safety-of-flight.

- No nozzle sample shall be taken after the aircraft has taxied into the designated hot refueling area. Sampling increases the possibility of a fuel spill in the presence of an ignition source.

2. The area shall be policed for FOD.

3. Verify that firefighting equipment is in the immediate vicinity of the loading operation. (line NCO)

4. Check for hot brake conditions. (nozzle operator/ plane captain)

WARNING

Hot refueling shall not be performed if a hot brake condition exists.

Note

Hot brake check is applicable to fixed-wing aircraft only.

5. Qualified squadron personnel shall verify all ordnance is safed. Safed is defined as the replacement of any mechanical arming level, safety pin, electrical interrupt plug/pin, securing of armament switches, and/or any appropriate action that renders the particular ordnance carried as safe.

Note

- Hot refueling of rotary-wing aircraft with explosive ordnance onboard is authorized at Forward Operating Bases (FOBs) and Forward Arming and Refueling Points (FARPs) in support of contingencies, operations, exercises, and training.

- Hot refueling of aircraft with explosive ordnance onboard is not authorized at established expeditionary airfields (e.g., SELF 29 Palms and MCALF Bogue) or at Marine Corps Air Stations and Marine Corps Air Facilities using tactical fuel systems (e.g., MCAS Yuma and MCAS Iwakuni).

18.5.3.2 Hot Refueling Procedures in the Refueling Area. Once the aircraft has been determined ready for entry into the hot refueling area, the following steps shall be performed:

1. The aircraft shall be taxied into the hot refueling area as determined by local SOPs. The aircraft shall enter the area with the refueling receptacle on the side of the aircraft nearest the refueling hose/nozzle. Primary aircraft directors are aircraft crew chiefs, plane captains or trained and qualified squadron personnel or visiting aircraft line personnel. Utilization of refueling personnel as aircraft directors will be restricted to FARPs.

WARNING

- Servicing the AV-8B's water injection system/tank is NOT authorized in the refueling area.

- The refueling hose shall not pass underneath the aircraft to reach the SPR receptacle. This may result in the severing of the hose in the event of malfunction or failure of the aircraft's landing gear.

- Aircraft canopy and side doors (if installed) shall remain closed during the entire hot refueling evolution. Aircraft refueling operations shall be secured if canopy is opened.

WARNING

- Crew changes and hot seating shall not be conducted in the fuel pits.

- Exceptions:

  — Rear cargo doors and/or doors on opposite side of aircraft from the refueling adapter may be open, provided the refueling hose is positioned so that it is unlikely fuel sprays from nozzle/adapter malfunction or hose rupture will enter aircraft passenger/cargo/cockpit compartment(s).

  — The AV-8B aircraft may be hot refueled with the canopy open at the pilot's discretion when high temperatures and humidity dictate since the aircraft's environmental control system does not operate with weight on wheels.

- Assume that both engines on dual-engine aircraft are operating. Although some aircraft can shut down the engine on the side where the refueling receptacle is located (F-14), most do not (e.g., F-18, A-6).

2. Pilot (or plane captain) shall secure all unnecessary electronic and electrical equipment not required for refueling.

WARNING

Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until evolution has been completed or refueling has been stopped for an emergency (e.g., NO aircraft engines or APU shall be started or stopped and external power shall NOT be connected, disconnected, or switched on/off). Changing the aircraft's electrical power status can create significant ignition sources.

3. Verify that manned firefighting equipment is in the immediate vicinity of the refueling operation and manned. (refueling point operator)

4. Attach a grounding cable from an established earth ground to the aircraft. (nozzle operator)

5. Zero the fueling system's meter or note the existing reading. (refueling point operator)

6. Pull out the refueling hose and place in proper position for refueling. (nozzle operator and refueling point operator)

7. Remove refueling adapter cap from the aircraft and the dust cover from the nozzle. Inspect the face of the nozzle to ensure it is clean and verify that the flow control handle is in the fully closed and locked position. (nozzle operator/plane captain)

8. Visually inspect the aircraft's adapter (receptacle) for any damage or significant wear. If any doubt about the integrity of the adapter exists, do not refuel.

WARNING

A worn or broken adapter can defeat the purpose of the safety interlocks of the refueling nozzle permitting the poppet valve to open and fuel to spray or spill.

9. Lift nozzle by lifting handles, align the lugs with the slots on the aircraft adapter, and hook up to the aircraft by pressing it firmly onto the adapter and rotating clockwise to a positive stop. (nozzle operator)

WARNING

Nozzle must seat firmly on the adapter and not be cocked. Cocking can indicate a malfunction of the nozzle's safety interlock system that can lead to a fuel spray or spill.

10. Upon receiving signals from nozzle operator/plane captain that hook-up has been completed and fueling operation is ready to begin, refueling

point operator signals the pump operator to charge the system allowing fuel to flow to the nozzle.

WARNING

- Deadman controls shall not be blocked open or otherwise inhibited. This defeats the purpose of the device and can lead to a catastrophic accident.

- Discontinue refueling immediately if any leaks are discovered throughout the operation.

11. When hose is fully charged, rotate the nozzle flow control handle to the FULL OPEN position. The handle shall rotate 180 degrees to ensure that the poppet valve is fully open and locked. (nozzle operator)

WARNING

The flow control handle of the single point pressure refueling nozzle shall be placed in either of two locked positions — fully open or fully closed. The handle is NOT to be used as a flag to indicate fuel flow. Excessive wear on the aircraft's adapter and the fuel nozzle poppet will result if the handle is allowed to float in the unlocked position.

12. Once fuel flow has been established, exercise the aircraft's precheck system. (plane captain)

Note

- The precheck system simulates the completion of a complete refueling by closing all of the tank inlet shut-off valves within the aircraft. All fuel flow into the aircraft should stop within a few seconds to 1 minute of actuating the precheck system. The refueling meter is the primary means of detecting that fuel flow has stopped and precheck was successful. If a meter is not available, successful precheck can be confirmed by observing the jerk and stiffening that occurs in the refueling hose and/or the pressure spike that occurs at the pump's discharge pressure gauge.

- Aircraft may be hot refueled if it fails precheck, but special procedures are required. Refer to appropriate aircraft NATOPS Manual. This should be done only as an operational necessity.

13. Fuel aircraft as directed by nozzle operator/plane captain. Nozzle operator/plane captain shall monitor aircraft vents, tank pressure gauge(s) and/or warning lights as necessary.

14. When directed by the nozzle operator/refueling point operator, stop the flow of fuel by using the deadman control if so equipped. (refueling pump operator)

15. Rotate the nozzle flow control handle into the OFF and fully locked position. (nozzle operator and verified by the refueling system operator)

WARNING

Failure to lock the flow control handle in the OFF position can contribute to a failure of the nozzle's safety interlock system and could result in a fuel spray or spill.

16. Disconnect nozzle from the aircraft adapter. (nozzle operator)

17. Disconnect the bonding cable from the aircraft. (nozzle operator)

18. Disconnect the earth ground from the aircraft and stow away to its proper position. (nozzle operator and refueling system operator)

19. Stow the hose and return the nozzle to its proper position. (nozzle operator and refueling system operator)

20. Complete paperwork. (refueling point operators)

21. Aircraft shall depart the hot refueling area under the guidance of a qualified aircraft director.

18.6 MULTIPLE SOURCE REFUELING

Normally, only one refueling truck at a time is used to service aircraft; however, there are situations when multi-truck servicing is considered desirable, especially when very large aircraft must be refueled. The advantage to multiple source refueling is reduced aircraft turnaround time. The aircraft's NATOPS Manual, USAF Technical Order (TO), or equivalent aircraft servicing manual shall be consulted for specific guidelines and instructions before such operations are performed. In addition, the instructions and guidelines on multi-source refueling contained in USAF TO 00-25-172 shall be followed since the vast majority of aircraft involved belong to the USAF. This TO is available from WR-ALC/MMEDT, Robins AFB, Georgia 31098. Specific aircraft TOs may be obtained from SA-ALC/MMEDT, Kelly AFB, San Antonio, TX 78241.

18.7 TRANSFERRING FUEL FROM ONE AIRCRAFT TO ANOTHER

Some special purpose operations have been developed in which fuel is removed from an aircraft and directly loaded into another aircraft (or ground vehicle). As discussed in paragraph 18.10 of this chapter, aircraft defueling is a very dangerous and demanding operation. In addition, the immediate reuse of fuel removed from an aircraft without proper filtration and handling can adversely affect safety-of-flight. Only NAVAIR approved transfer operations are authorized. Appropriate safety precautions shall be observed at all times during these operations. Specific examples of approved operations listed below:

1. Refueling aircraft, fuel storage bladders, or ground vehicles from KC-130 aircraft.

2. Refueling aircraft, fuel storage bladders, or ground vehicles from CH-53 aircraft.

3. Transfer of fuel between aircraft using Plane-to-Plane Transfer Cart. For a detailed description of this equipment and procedures for its use refer to Chapter 6, paragraph 6.2.10.2 of this NATOPS Manual.

18.8 REFUELING AIRCRAFT WITH APU IN OPERATION

The aircraft APU may be used to supply electrical power for pressure refueling on military aircraft so equipped and commercial aircraft (when the procedure is approved by the FAA for a carrier's aircraft in commercial operation). This operation is not considered "hot refueling"; however, the following precautions shall be observed in addition to the normal refueling procedures.

1. One person shall remain outside the aircraft within 10 feet of the APU exhaust with a fire extinguisher of the size specified by the Fire Chief.

2. Refueling point operator will verify that the aircraft is grounded and bonded.

3. One person shall be located at the GTC controls in the cockpit.

4. Intercom shall be established between the cockpit and personnel performing refueling to ensure immediate shutdown in the event of an emergency.

5. Personnel in the vicinity of the aircraft shall wear sound-attenuating ear protectors.

18.9 CONCURRENT ON-LOADING/ OFF-LOADING AND REFUELING OF AIRCRAFT

Station/activity or FOB COs may grant authorization to the FO for concurrent refueling, cargo loading, and cargo off-loading (including passengers) in logistical airlift operations when minimal ground time is required to support military operations. Such authorization shall not include the loading and unloading of Class A and B explosives, but can include refueling with explosive cargo previously loaded and secured onboard.

Where concurrent refueling/loading/off-loading operations are authorized, COs shall establish local regulations and procedures to ensure safety. In addition, the CO shall clearly designate one qualified person in charge of each operation. For reference purposes in this chapter, the person in charge will be called the Quick

Service Supervisor (QSS), but in actual practice both his/her title and qualifications will be detailed in local regulations.

All tasks concerning the operation will be performed under the observation and control of a QSS. The QSS will be present at the site and shall be responsible and have jurisdiction, authority, and coordination over all service operations including refueling trucks/equipment, fueling procedures, power units, loading/unloading equipment, passenger management, and communication systems to ensure safety of all aspects of refueling operations. No concurrent refueling shall commence until the QSS has been identified and established in control. The refueling will commence only upon a signal from the QSS.

The following procedures and precautions shall be included in the local regulations and procedures:

1. All vehicles to be operated within a 50-foot radius of the refueling point shall be equipped with spark arrestors and designated in advance.

2. Appropriate size and type fire extinguishers as recommended by NAVAIR 00-80R-14 shall be located in the immediate vicinity.

3. A stand-by crash truck shall be required at the aircraft when passengers or patients remain onboard during concurrent refueling operations.

4. When passengers or patients are permitted to remain onboard, necessary ramps (unobstructed) shall be located in proper position to permit evacuation. In addition, an attendant shall be assigned to enforce the no smoking rule and prohibit passengers from entering hazardous areas.

5. Some large refuelings require multiple truck servicings that continue throughout the major portion of the scheduled ground time. When this coincides with operational situations of extreme urgency, it may be necessary to enplane and deplane passengers during refueling. If such extreme measures are necessary, it is recommended that it be contingent upon additional authorization of the CO or the Command Duty Officer. If authorization is given, passengers paths shall avoid hazardous areas. A passenger attendant shall be assigned to prohibit passengers from entering hazardous areas.

6. Aircraft maintenance repair work or liquid oxygen servicing shall not be permitted during refueling.

7. A communication system (radio vehicle or other effective means) shall be maintained to permit the CO's designated person-in-charge to contact the crash fire truck in the event of an emergency.

8. Clear paths shall be maintained around aircraft being serviced at all times.

18.10 DEFUELING AIRCRAFT

Defueling is one of the most technically demanding and potentially dangerous operations performed by fuels personnel. Most aircraft defueling equipment has the capability of defueling an aircraft faster than an aircraft can release it. The pump's effluent (discharge) shall be regulated to balance its influent (fuel from aircraft) in order to prevent pump cavitation and/or the loss of suction, which would necessitate reflooding of the pump. Once the proper balance is achieved it must be maintained by manipulation of the valve on the downstream side of the pump throughout the defueling operation.

WARNING

Assignment of inadequately trained or inexperienced personnel to defueling operations can result in catastrophic accidents.

Defuelings normally have lower priority than refuelings. A defuel request for an aircraft that is leaking fuel shall be considered an emergency and handled promptly.

WARNING

The desire to satisfy customer requests for the acceleration of the process shall not be granted.

The following rules apply to every defueling operation:

1. Aircraft defueling shall be requested by an authorized representative of the squadron's CO using an Aircraft Defueling Certificate similar to Figure 12-12.

2. During defueling operations, no other maintenance not directly required to facilitate the defueling operation is prohibited.

3. Aircraft shall be spotted 50 feet from all structures and other aircraft. Grounding and tie down pad-eyes shall be available. In addition, at least one fire extinguisher having an ANSI rating of not less than 20-B shall be available in the immediate vicinity of the operation.

4. Suspect aviation turbine fuel shall be removed from the aircraft using a defueler only (not a refueler/defueler) and deposited in a designated holding tank. Ultimate disposition will depend on the results of subsequent laboratory tests. Every effort shall be made to reclaim off-specification fuel as JP-5, F-76, or fuel oil reclaimed (FOR).

5. All fuel removed from turbine engined aircraft shall be assumed to be a mixture of JP-4 and JP-5. Defueled turbine fuel shall therefore not be returned to JP-5 storage tanks without first confirming the flash point of the material to be 140 °F or higher.

6. Fuel containing leak detection dye can be reissued to aircraft of the same squadron as long as the squadron's requesting official signs a statement that the fuel is nonsuspect and is safe for use. Note that although refuelers/defuelers may be used to defuel dyed fuel, logistics problems may arise since several loads of fuel may be needed to flush the dye out of the refueler/defueler. The fuel may appear off-color when sampled prior to issue to another squadron's aircraft.

7. The FO shall personally decide the disposition of all defueled product. Advice is readily available from NAVPETOFF.

8. The defueling unit is required to maintain a flooded suction above the anti-vortex splash plate in its tank in order to minimize turbulence and possible ingestion of air. Historically a minimum of 1,000 gallons has been required in the defueling unit to resolve turbulence and air ingestion problems. Due to the wide variety of configurations of pump piping systems and tank sizes, 1,000 gallons of product may or may not be sufficient. It is up to the local commands to determine the minimum amount by using manufacturers' technical manuals and historical data.

9. Valve(s) that control the flow of fuel from the tank to the upstream side of the pump shall remain closed during defueling operations. This is to prevent the recirculation of product in the tank. Valve(s) may be opened to prime the pump only when the pump is not operating.

10. If during the defuel operation the pump starts to lose prime or cavitates, the operation will be discontinued until the problem is resolved and the fuel supervisor has authorized a restart.

CAUTION

At no time will a restart be authorized without waiting a minimum interval of 1 minute to allow relaxation of any static charge.

11. Defueler tank tops shall remain closed during defueling operations.

12. Every aircraft defueling operation requires a minimum of three people — the defueler truck/vehicle operator, a nozzle operator, and a fire watchperson.

13. A special log of each defueling operation shall be maintained. The following minimum information shall be contained in the log:

    a. Complete list of all squadron personnel authorized to sign defuel request forms. This list will be updated at least quarterly.

    b. All abnormal happenings.

    c. Aircraft BUNO number.

d. Defueler number.

e. Grade of product.

f. Amount of product actually defueled vice what was scheduled to be removed.

g. Scheduled amount to have been defueled.

h. Disposition of product.

i. Times of the day when the defuel operation was started and completed.

j. Names of defueler operator and squadron personnel present during the defuel operation.

18.10.1 Defueling Procedures. Aircraft defueling tasks are to be performed in the following sequence:

1. Prior to initiating the defuel operation, take samples of the fuel to be defueled from the aircraft's drains and visually inspect them for contaminants. (qualified squadron personnel under the observation of the vehicle operator)

2. Determine the status of the fuel (i.e., suspect or nonsuspect (vehicle operator)). The person requesting the defueling operation shall confirm that the fuel is or is not suspect. Fuel is considered suspect if the aircraft has malfunctioned and the fuel is believed to have contributed to the problem or the fuel is thought to be of the wrong type; e.g., AVGAS or automotive gasoline instead of aviation turbine fuel.

3. Determine amount of fuel to be removed from the aircraft (vehicle operator). Again the squadron personnel requesting the defueling operation shall provide this estimate as part of the official request.

Note

If the aircraft is being defueled due to a faulty (or suspect) fuel quantity gauging system, it will be difficult to estimate amount of fuel in the aircraft.

4. Select defueling equipment to be used; e.g., defueler for suspect product or refueler/defueler for nonsuspect fuel (FO and supported squadron's spokesperson). Always check the remaining capacity of the defueler or refueler/defueler to make sure there is adequate room to hold the material being defueled. In addition, remember that sufficient fuel shall be in the defueling tank to maintain a flooded suction above the anti-vortex splash plate.

5. Position the defueler (vehicle operator).

6. Verify that aircraft is spotted properly. (all personnel)

7. Ground defueler.

8. Ground aircraft.

9. Check for possible sources for ignition. (all personnel)

10. Verify that the defueling request chit corresponds to the instructions from the dispatcher. (vehicle operator)

11. Connect bonding wire from defueler to aircraft. (vehicle operator)

12. Unload, position, and connect the defuel hose to the aircraft and the defueler stub on the defueler. (nozzle operator/plane captain)

13. Commence defueling upon signal from the nozzle operator. (truck operator)

14. Adjust valve downstream of pump to optimize defuel rate. (defueler operator)

Note

Maximum defuel rate is 100 gpm (truck operator). When nearing completion of the defuel process, very close attention shall be paid to the defuel rate in order to prevent pump cavitation and/or loss of prime.

CAUTION

Discontinue defueling of an aircraft if pump cavitation is a persistent problem.

15. Upon completion of a defuel operation, secure all equipment and CHECK THE AREA FOR FOD. (all personnel)

18.10.2 Disposition of Nonsuspect Fuel Removed from Aircraft. All USN and USMC aircraft are authorized to use JP-4, JP-8, commercial JET A and JET A-1, as well as JP-5 fuel. Fuel removed from a USN or USMC aircraft will contain mixtures of these fuels and the specific grade of fuel will be impossible to determine without extensive specification testing. USA and USAF aircraft may also contain such mixtures. Therefore, fuel in any properly operating DOD aircraft with turbine engines, which is NOT suspect of being contaminated, can be defueled into a designated refueling vehicle and then used to refuel any aircraft with the user's knowledge and permission. First preference shall be given to using the fuel to load an aircraft in the same squadron as that from which the fuel originated. Second choice shall be to issue the fuel to aircraft having engine fuel controls that automatically compensate for fuel density changes. Aircraft with T56 engines, such as the P-3 and E-2, should be preferentially used since these engines are the most tolerant to such fuel changes. In addition the following rules apply to reissuing defueled fuel:

1. Since fuel removed from any aircraft almost definitely has a flash point below 140 °F, it shall not be used to refuel any aircraft scheduled for immediate sea duty.
2. Any designated defuel/refueler must pass fuel through filter/separators and fuel monitors before reaching the aircraft.
3. The FSII content of defueled turbine fuel shall be checked using the nearest supporting laboratory prior to refueling USN S-3, US-3, and SH-60 aircraft, and all U.S. Army and U.S. Air Force and foreign aircraft.

Nonsuspect fuel that has been dyed for the detection of aircraft fuel system leaks can also be used in aircraft provided the above procedures are followed.

Nonsuspect fuel removed from piston-engined aircraft can also be reissued provided:

1. The fuel is a known grade (80/87 or 100/130).
2. The fuel is properly filtered before reissue.

18.10.3 Disposition of Suspect Fuel Removed from Any Aircraft. Fuel removed from any aircraft that has recently experienced engine or airframe fuel system problems possibly related to fuel quality will be segregated by collecting in a designated defueler, a clean storage tank, or any container as "salvage fuel." It will then be sampled and tested to determine if it is in conformance with the deterioration use limits outlined in Appendix B. If the fuel tests within the established limits, it shall be returned to station storage and reissued as the grade and type determined providing adequate filtration and water separation can be accomplished prior to dispensing the fuel.

18.10.4 Handling NATO F-37 (JP-8+100) Fuel. TO F-37 (JP-8+100) is NATO F-34 (JP-8) which has been additized with a thermal stability improving additive. The thermal stability additive is a dispersant/detergent that:

1. Disarms filter-coalescer elements
2. Makes free water readings taken with the AEL Free Water Detector (a component of the CCFD) and the Aqua-Glo Free Water Detector unreliable.

Note

Water absorbent filter elements (fuel monitors) will continue to work in the presence of NATO F-37 fuel.

USN/USMC aircraft are not authorized to use NATO F-37. It is possible that USN/USMC aircraft may receive NATO F-37 inadvertently when conducting joint operations requiring refueling from air stations operated by NATO member air forces that utilize NATO F-37.

Note

NATO F-37 is not authorized for use in USAF or other NATO member nations' aerial refueling aircraft.

If aircraft are suspected of having received NATO F-37, and need to be defueled, handle defueling as follows:

WARNING

Do not, under any circumstances, place NATO F-37 into a tactical fuel unit's aviation fuel storage/delivery system.

3. Defuel into refueler/defueler and immediately reissue fuel (as long as no other contamination is suspected). Priority of reissue shall be as follows:

   a. Directly to same or other aircraft

   b. To aviation ground support equipment

   c. To aviation test cells.

4. If other contamination is suspected, all fuel defueled from the aircraft shall be treated as hazardous waste and handled accordingly.

5. After reissuing NATO F-37 fuel from refueler/defueler, the following steps shall be taken:

   a. Refill the refueler/defueler with NATO F-44 (JP-5) or NATO F-34 (JP-8).

   b. Note the differential pressure readings for the filter-coalescer elements and fuel monitor elements.

   c. Issue fuel to aircraft following normal operating procedures.

   d. Monitor the differential pressure across the fuel monitor elements.

   e. Change both the filter-coalescer elements and the fuel monitor elements when the differential pressure across the fuel monitor elements reaches 15 psi or the fuel flow degrades significantly.

Notify TYCOMs and AIR-4.4.5 via naval message of any actual/suspected NATO F-37 defueling.

18.10.5 Disposition of Fuel that Does Not Meet the Allowable Deterioration Limits. Fuels that do not meet the allowable deterioration use limits of Appendix B will be handled as directed below.

18.10.5.1 Disposition of Aviation Turbine Fuels. Aviation turbine fuels that do not meet the requirements specified herein generally cannot be downgraded for any aircraft use. The only significant exception to this rule is JP-5 which has a reduced flashpoint due to mixing with other turbine fuel. As explained above, this fuel is perfectly acceptable for use in USN and USMC aircraft. It should not, however, be loaded aboard aircraft scheduled for immediate sea duty. Questions concerning the use or disposition of fuel not meeting the deterioration use limits should be referred to the NAVPETOFF, Operations Division (Code 40), DSN 427-7357; commercial 703-767-7357. In no case will fuel not meeting the deterioration use limits of Appendix B be allowed to mix with existing uncontaminated aircraft fuel.

18.10.5.2 Disposition of Aviation Gasoline. Any questions concerning the use or disposition of fuel not meeting the use limits should be referred to the NAVPETOFF, Operations Division (Code 40), DSN 427-7357; commercial 703-767-7357.

18.11 PRODUCT RECEIPT

18.11.1 Bulk Transfer Line Receipt of Product. Bulk transfer line receipt operations are relatively simple and therefore require minimum personnel. Bulk transfer operations rarely occur between the FMF's Wing and FSSG units in a training environment; however in the event of such an operation, the following procedures apply:

1. Advise supporting unit of requirements (e.g., when required, amount, special instructions, etc.)

2. Effect liaison with the unit providing the product and ensure an adequate communications network is established in order to control the flow of product. Maintain communications throughout the bulk transfer operation.

3. Visit the supporting unit and conduct a joint inspection of their bulk transfer line.

4. Conduct a joint test of the product to be received per paragraph 15.2.1.2 of this NATOPS Manual.

5. Maintain an operations observer with the supporting unit until completing of the bulk transfer operation. This is a precautionary measure that should be followed when a supporting unit's personnel proficiency cannot be personally guaranteed by the FO or his senior representative.

6. Identify a segregated container/tank into which the initial purge will be directed (sump). Once contaminants have settled out or been removed through filtration this initial purge fuel may be used. If the supporting unit provides an in-line

filter separator at the receiving system, the initial purge should not be a concern. (This is the recommended method of receipt.)

7. Ensure all manifolding/valves within the system are properly positioned (open/closed) to direct the fuel into the predetermined tanks. Ensure personnel are on sight to monitor the receipt and open/close valves as necessary to redirect the flow of fuel to other tanks in the receiving system.

8. Provide line walkers as required. Coordinate with the supporting unit to ensure they have provided line walkers on their bulk transfer line also.

9. Provided the fuel is suitable for use, initiate delivery via the established communications link. Maintain communications throughout the transfer evolution.

10. Monitor flow of fuel until complete.

11. Inspect system components as required in applicable TMs (e.g., TM3835-15/1).

12. Incorporate quality surveillance steps as required prior to dispensing fuel to aircraft.

18.11.2 Tank Truck/Tank Car Receipt of Product. Incoming tank trucks and tank cars of aircraft fuel can arrive separately or in groups. All shall be sealed at the source of supply. Unloading of tank trucks is a two-man operation. The following procedures apply to both tank truck and tank car receipt:

1. Ensure that seals are intact (applies to fuels received from external sources).

2. Verify that seal number is identical to that on the shipping document.

3. Verify the specification and grade number of the product on the shipping document.

4. Ensure that the fuel level coincides with the quantity on the shipping document.

5. Take samples after drawing off water (if present).

6. Make visual test of samples.

7. Unload product into suitable storage tank.

8. Check vehicle's tank interior after delivery.

9. Upon completion of fuel receipt (multiple tank cars or truck loads), sample storage tank and perform quality control test.

18.11.3 Change of Product in Aircraft Defuelers. Change of product in mobile refuelers shall be performed in accordance with Figure 12-13. Product that is used to flush tanks and piping shall be treated as contaminated fuel. Samples shall be visually inspected for sediment and water and its specific gravity shall check within 0.5 degrees of the corrected API of the appropriate product in storage.

18.11.4 Change of Product in Storage Tanks. Refer to the container's supporting publications and directives (e.g., 20,000-gallon collapsible tank, TM-3835-15/1).

18.12 FORWARD ARMING AND REFUELING POINT (FARP) PROCEDURES

The procedures in this section are for use in a Forward Arming and Refueling Point (FARP). Cold and hot refueling of helicopters carrying ordnance are authorized in a FARP.

18.12.1 Personnel Requirements. A minimum of six personnel (not including four ordnance personnel) are required for cold or hot refueling aircraft at a two-point FARP (if the FARP contains additional points, the number of personnel required will increase). Three personnel are required for mobile cold refueling an aircraft at a single point. All personnel performing refueling operations shall be fully trained and qualified in accordance with Chapter 14 of this manual.

18.12.1.1 Two-Point FARP Personnel Requirements

1. Pump/vehicle operator (one per pump). This person shall be a fully qualified operator from the local fuels organization. This person shall be positioned at the pump/deadman control and maintain a clear line of sight with the refueling point operator and nozzle operator. Duties include actual operation of the deadman control (M970) or pump (SIXCON and HERS).

2. Nozzle operator (one per aircraft). The pilot or crew chief performs this duty. This person shall be fully trained and certified for refueling duties

related to the specific aircraft type/model/series being refueled. (See paragraph 14.2.3.) Duties shall include the performance of necessary aircraft refueling checks. The nozzle operator shall remain at the nozzle throughout the refueling and leave only to conduct necessary vent checks.

3. Refueling point operator (one at each refueling point). Duties include zeroing the meter, grounding the aircraft, ensuring the nozzle operator has bonded the nozzle to the aircraft prior to refueling, assisting in nozzle hook-up, manning the fire extinguisher during actual refueling operations, chocking wheels (if cold refueling assault aircraft), and completion of required paper work.

4. Line NCO (one every four points after the first two points). Duties include pre-operational fuel systems checks and monitoring the overall safety procedures while aircraft are in the FARP area.

18.12.2 Equipment Requirements. The following equipment is the minimum required to conduct refueling operations at FARP sites:

1. One fuel service system, such as a SIXCON, HERS, or an M970 (configured with external hoses, etc.). The system shall possess all the required features listed in Chapter 17 (e.g., filter/separator, fuel monitor).

WARNING

- Large static producing equipment and the aircraft being refueled must be grounded to Earth through a connection of 10,000 ohms or less.

- Stationary refueling equipment (HERS) shall be positioned a minimum of 150 feet from the aircraft refueling line.

- Mobile refueling equipment (M970, SIXCON) shall be positioned a minimum of 150 feet from the aircraft refueling line during hot refueling.

WARNING

Stationary hot refueling points shall be positioned a minimum of 150 feet apart.

2. Bonding cable attached to refueling nozzles that provides an overall resistance of 10,000 ohms or less.

3. Night Vision Devices (NVD). The Line NCO, pump/vehicle operator, and at least one of the ordnance personnel, should have a night vision capability for night operations.

4. Appropriate eye, ear, and head protection; long-sleeved shirts; and long pants for each member are mandatory. Personnel shall avoid wearing shoes that have nails or other metal devices on the soles, which can cause sparking.

5. Fire extinguisher. A 30-pound potassium bicarbonate (or apparatus with the same or better capability) fire extinguisher is required at each aircraft refueling point. Additionally, the minimum aircraft rescue firefighting capability in accordance with NAVAIR 00-80R-14, Aircraft Recovery and Fire Fighting (ARFF) NATOPS Manual is required.

WARNING

All ground personnel involved in FARP refueling operations shall be qualified in the operation of the fire extinguishing equipment in use.

18.12.3 Communication Procedures. Communications between ground to ground and air to ground personnel is required. The FARP shall be equipped with VHF-FM and UHF radios to expedite control/emergency measures during refueling operations. Radio transmissions shall be kept to a minimum during dearming, refueling, and arming procedures. Aircraft and ground personnel should make initial contact with one another prior to aircraft entering the FARP.

CAUTION

Due to the complexity and inherent danger of FARP operations, especially those conducting hot refueling with explosive ordnance onboard, FARP OIC/Air Boss responsibilities shall be assigned to a person with the training and experience to adequately carry out these duties. FARP OIC/Air Boss shall have a working knowledge of the Marine Aviation Command and Control System (MACCS) sufficient to allow him to deconflict and control aircraft in and around the FARP site, establish priority of support within the FARP based on mission requirements, and provide transitioning pilots with situational updates as required.

Note

- Fueling personnel should be positioned so that a clear line of sight is always maintained with all essential personnel so that hand and arm signals may be effectively passed.
- At a minimum, the following personnel will have established communications for proper control:
- Aircraft to FARP OIC or Air Boss.
- FARP OIC to ordnance.
- FARP OIC to fuels.
- FARP OIC to ARFF.
- Fuels to fuels.
- Fuels to ordnance.

18.12.4 Fueling Helicopters with Engines Not Operating (Cold Refueling). Cold refueling shall be performed when operational requirements permit. This operation is significantly less dangerous and costly, in terms of fuel and manpower expenditures, compared to hot refueling. Cold refueling may be performed with the SPR, CCR, or gravity (open port) nozzles.

18.12.4.1 FARP Cold Refueling Sequence of Events

1. Aircraft enter FARP and land at designated spots.
2. Aircraft are dearmed and shut down.
3. Aircraft are refueled.
4. Aircraft are uploaded as required.
5. Aircraft restart.
6. Aircraft are rearmed.
7. Aircraft depart FARP.

WARNING

Aircraft should avoid overflying other aircraft in the FARP to minimize potential for aircraft mishaps.

CAUTION

Prior to aircraft departure, communication should be re-established between aircraft and FARP OIC/Air Boss for clearance to depart the FARP.

18.12.4.2 Initial Cold Refueling Procedures. The following steps shall be accomplished prior to aircraft entering the cold refueling area.

1. Recirculate (flush) the system or mobile refueler's hoses and take a fuel sample for quality control checks as appropriate. (refueling point operator)

WARNING

Fuel shall be recirculated/flushed through the refueling hose and nozzle, and tested for contamination prior to issuing fuel each day. Fueling shall not begin until acceptable results have been obtained (see Chapter 15). Failure to provide clean, dry fuel can adversely affect safety-of-flight.

2. The area shall be policed for foreign object debris (FOD) when feasible.

3. Verify that appropriate firefighting equipment is in the FARP.

4. Ensure that all visual landing aids (e.g., panel markers, NVG-compatible lighting) are securely anchored/attached to the ground at the landing points. For required lighting configuration, refer to NAVAIR 00-80T-115.

5. Ensure that adequate spacing has been established between the landing/refueling points (see Figure 18-1).

WARNING

- Brown-out conditions adversely decrease the safety-of-flight in the FARP. All precautionary measures should be taken to increase the safety-of-flight.

- At no time will an aircraft land or change direction so the nose is pointed toward personnel or equipment except as outlined in paragraph 18.12.5.3, step 2. (See Figure 18-1 for landing direction.)

Note

- Required minimum distance between attack/utility helicopters is 150 feet.

- Required minimum distance between assault support helicopters is 150 feet.

- The required distance of 150 feet between attack/utility helicopters on line may be reduced to 100 feet, if the situation (terrain limitations and number of aircraft) warrants it; however this reduction in separation does not apply to the minimum safe distance of 300 feet for either dearming or arming procedures and refueling operations.

- The aircraft shall approach the FARP area on a safe heading, as depicted. All aircraft will land/position themselves with the nose of the aircraft placed on the landing/refueling point. Taxi directors will not be used during cold refueling procedures outlined in this section. (See Figure 18-1.)

18.12.4.3 Ordnance Procedures. Once the aircraft have landed at their respective landing/refueling points, the following steps shall be performed:

1. After landing, each aircraft will be dearmed.

2. Qualified ordnance personnel shall verify all ordnance is safe prior to commencing any refueling operations. Safe ordnance is defined as the repositioning of any mechanical arming lever(s), and or any replacement of safety pin, electrical interrupt plug/pin, securing of armament switches, and/or appropriate action that renders the particular ordnance carried as safe.

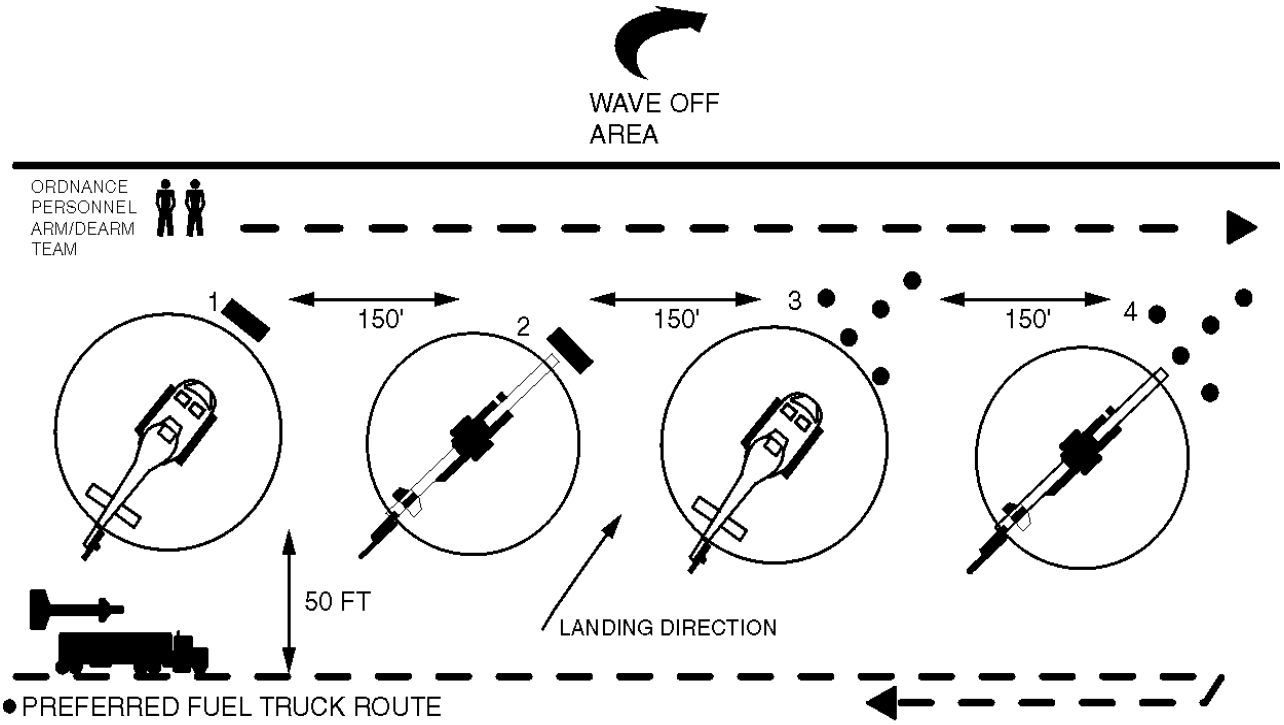
3. If possible, arming and dearming routes should occur to the front of the aircraft in succession from first to last landing point (see Figure 18-1).

WARNING

Care shall be exercised to prevent ordnance personnel from passing in front of armed weapons (see Figure 18-1).

4. In case of a malfunction (e.g., jammed gun) on an aircraft, operational procedures may continue on all other aircraft. However, no refueling may occur on or within 300 feet of the affected aircraft until the malfunction is cleared.

5. All hazards of electromagnetic radiation to ordnance (HERO) and high frequency (HF)



- PREFERRED FUEL TRUCK ROUTE FOLLOWED BY ORDNANCE TRUCK.

- WHEN REFUELING HELICOPTERS ON LINE, POSITION REFUELER SO THE MAXIMUM DISTANCE HOSE LENGTH CAN BE USED.

CAUTION: AT NO TIME SHALL A TRUCK APPROACH CLOSER THAN 10 FEET OF AN AIRCRAFT.

NOTE: THE FUEL/ORDNANCE TRUCK MAY ENTER FROM EITHER SIDE IN ACCORDANCE WITH APPLICABLE REFUELING PROCEDURES AND TERRAIN APPRECIATION.

NOTE: FUEL TRUCK/ORDNANCE CREWS STAGE 300' AWAY FROM LANDING POINTS. ALL ROTOR MOTION WITHIN 300' MUST BE STOPPED PRIOR TO ENTRY.
FARP FUELING/ORDNANCE PROCEDURES:
1. DEARM 2. FUEL 3. UPLOAD, IF REQUIRED 4. ARM

WARNING: SIMULTANEOUS FUELING AND ORDNANCE WORK WILL BE DONE WITH A 300' SEPARATION.

WARNING: CARE SHALL BE EXERCISED TO PREVENT ORDNANCE PERSONNEL FROM PASSING IN FRONT OF ARMED WEAPONS.

POSITION IR LIGHT/CHEMLIGHT FOR NIGHT OPERATIONS. **5' – 10' SHALL BE ESTABLISHED BETWEEN LIGHTING.**

PANEL MARKERS FOR DAY OPERATIONS. ENSURE PANEL IS ANCHORED SECURELY TO THE GROUND TO PREVENT LIFTING.

Refuel-F042

Figure 18-1. Multi-Point FARP for UH-1/AH-1 Helicopters (Cold, On Line)

procedures will be strictly adhered to in accordance with applicable NATOPS manuals.

WARNING

- At a cold FARP, there will be NO simultaneous refueling and uploading of ordnance on a single aircraft. However, either procedure may be performed on separate aircraft as long as there is a minimum of 300 feet separation between aircraft.

- Due to simultaneous fueling and uploading procedures occurring on separate aircraft, all personnel shall maintain an awareness of required distances during these phases.

18.12.4.4 Stationary System (HERS) Cold Refueling Procedures. The procedures contained in paragraph 18.3 apply to cold refueling in a FARP site using a stationary (HERS) system.

18.12.4.5 Mobile Refueler (M970/SIXCON) Cold Refueling Procedures

18.12.4.5.1 Refueler Parking Area. Refueling vehicles shall never be left unattended when engines are operating or when refueler is in the refueling/landing area. Operators may assist in such tasks as hose handling, checking for leaks around the refueler, placing or removing grounding devices, and the actual refueling evolution.

18.12.4.5.2 Refueler Positioning. Mobile refuelers shall be positioned in the staging area so that they have an unobstructed path to and from the landing/refueling area. When terrain permits, the preferred refueler approach to the aircraft will be perpendicular to the refueling adapter. The refueler should maintain a safe distance of 50 feet, so that the maximum hose length is used during refueling; however, at no time shall a truck approach closer than 10 feet of an aircraft. Positioning between aircraft should be avoided. When the preferred approach is not possible, the refueler shall be positioned so it can be driven away quickly in case of an emergency. Preferred refueler route is illustrated in Figure 18-1.

WARNING

- Mobile refuelers shall not be positioned in front of any aircraft loaded with forward firing ordnance.

- To prevent accidental contact with aircraft, equipment, or personnel during periods of reduced visibility, ground guides shall be used.

Note

Staging of mobile refuelers should be a minimum distance of 300 feet from the nearest landing/refueling point. This distance also applies when aircraft are landing in the FARP and the mobile refueler is in close proximity (conducting refueling operations). If encroachment within this minimum separation distance is unavoidable, refueling/movement of mobile refueler shall cease until adequate separation is established.

18.12.4.5.3 Pressure Refueling (Cold)

1. All nonessential personnel onboard the aircraft will disembark prior to refueling commencing.

2. Crew changes shall not occur during actual fueling of the aircraft.

CAUTION

The refueling hose shall not pass underneath or around the aircraft to reach the SPR receptacle.

3. Secure all unnecessary electronic and electrical equipment not required for refueling. (pilot/aircrew)

WARNING

Once a fueling evolution has commenced,

connections shall not be changed until the refueling evolution has been completed or refueling has been stopped for an emergency (i.e., NO aircraft engines or APU shall be started or stopped and external power shall NOT be connected, disconnected, or switched on/off). Changing the aircraft's electrical power status can create significant ignition sources.

4. Ensure that firefighting equipment is in the immediate area of the refueling operation and manned for rapid response. (refueling point operator)

5. Attach a grounding cable from an established earth ground to the aircraft. (nozzle operator)

6. Zero the fueling system's meter or note the existing reading. (refueling point operator)

7. Pull out the refueling hose and hand the nozzle to the nozzle operator. (refueling point operator)

8. Remove refueling adapter cap from the aircraft and the dust cover from the nozzle. Inspect the face of the nozzle to ensure it is clean, and verify that the flow control handle is in the fully closed and locked position. (nozzle operator/refueling point operator)

9. Visually inspect the aircraft's adapter (receptacle) for any damage or significant wear. If any doubt about the integrity of the adapter exists, do not refuel.

WARNING

A worn or broken adapter can defeat the purpose of the safety interlocks of the refueling nozzle, permitting the poppet valve to open and fuel to spray or spill.

10. Ensure the nozzle bonding plug/clamp is connected/attached to aircraft prior to nozzle hookup. (nozzle operator)

11. Lift nozzle by lifting handles, align the lugs with the slots on the aircraft adapter, and hook up to the aircraft by pressing it firmly onto the adapter and rotating clockwise to a positive stop. (nozzle operator)

WARNING

Nozzle must seat on the adapter and not be canted. Canting can indicate a malfunction of the nozzle's safety interlock system, which can lead to a fuel spray or spill.

12. Rotate the nozzle flow control handle to the FULL OPEN position. The handle shall rotate 180° to ensure that the poppet valve is fully open and locked. (nozzle operator)

WARNING

The flow control handle of the single point pressure refueling nozzle shall be placed in either of two locked positions — fully open or fully closed. The handle is NOT to be used as a flag to indicate fuel flow. Excessive wear on the aircraft's adapter and the fuel nozzle poppet will result if the handle is allowed to float in the unlocked position.

13. Upon receiving signals from nozzle operator that hook-up has been completed and fueling operation is ready to begin, the refueling point operator signals the pump operator to charge the system, allowing fuel to flow to the nozzle.

WARNING

Deadman controls, where provided, shall not be blocked open or otherwise inhibited. This defeats the purpose of the device and can lead to a catastrophic accident.

WARNING

Discontinue refueling immediately if any leaks are discovered throughout the operation. All repairs/maintenance will be performed away from the aircraft to avoid mishap in the event of a leak or hose rupture, etc.

14. Fuel aircraft as directed by nozzle operator. Nozzle operator shall monitor aircraft vents, tank pressure gauge(s), and/or warning lights as necessary.

15. When directed by the nozzle operator/refueling point operator, stop the flow of fuel by using the deadman control if so equipped. (refueling pump operator)

16. Rotate the nozzle flow control handle into the OFF and fully locked position. (nozzle operator and verified by the refueling system operator)

WARNING

Failure to lock the flow control handle in the OFF position can contribute to a failure of the nozzle's safety interlock system and could result in a fuel spray or spill.

17. Disconnect nozzle from the aircraft adapter. (nozzle operator)

18. Disconnect the bonding cable from the aircraft. (nozzle operator)

19. Disconnect the Earth ground from the aircraft, and stow away to its proper position. (nozzle operator and/or refueling system operator)

20. Replace the dust cover, stow hose and return the nozzle to its proper position. (nozzle operator and refueling system operator)

21. Complete paperwork. (refueling point operator)

22. As required, ordnance personnel will arm aircraft.

23. Once aircraft have been refueled and armed, the aircrew should contact FARP OIC/Air Boss for clearance to depart the FARP.

18.12.4.5.4 Over-Wing/Open Port Refueling. Once the refueler is in position, conduct fueling operations as follows:

WARNING

Over-wing refueling with the aircraft's engines operating is NOT authorized.

1. All nonessential personnel onboard the aircraft shall disembark prior to refueling commencing.

2. Crew changes shall not occur during actual fueling of the aircraft.

CAUTION

The refueling hose shall not pass underneath or around the aircraft to reach the SPR receptacle.

3. Secure all unnecessary electronic and equipment not required for refueling. (pilot/aircrew)

4. Verify that firefighting equipment is in the immediate vicinity of the refueling operation and manned.

5. Attach a grounding cable from an established Earth ground to the aircraft. (vehicle operator)

6. Attach a grounding cable from an established Earth ground to the refueling vehicle. (vehicle operator)

7. Zero the refueling system's meter or note the existing reading. (vehicle operator)

8. Pull out the refueling hose and place in proper position for refueling. (nozzle operator and vehicle operator)

9. Bond the over-wing nozzle to the aircraft. (nozzle operator and vehicle operator).

WARNING

Always bond the nozzle to the aircraft before the cap is removed. This connection shall remain in place until the entire fueling operation is complete. Failure to bond nozzle and/or maintain contact can result in a dangerous static spark inside the fuel tank.

10. Remove the refueling cap from the aircraft and the dust cover from the nozzle. (nozzle operator)

11. Insert over-wing nozzle into the aircraft's refueling port, and maintain metal-to-metal contact between the nozzle and the aircraft's refueling port throughout the entire fueling operation. (nozzle operator)

12. Upon receiving signals from nozzle operator that hook-up has been completed and fueling operation is ready to begin, refueling point operator charges the system, allowing fuel to flow to the nozzle.

WARNING

Deadman controls, where provided, shall not be blocked open or otherwise inhibited. This defeats the purpose of the device and can lead to a catastrophic accident.

13. Nozzle operator shall squeeze the handle on the over-wing nozzle to initiate fuel flow and fuel aircraft. Nozzle operator shall monitor aircraft vents, tank pressure gauge(s), and/or warning lights as necessary.

14. When directed by the nozzle operator, stop the flow of fuel. (Use deadman control if being utilized.) (refueling point operator)

15. Remove the nozzle from the aircraft. (nozzle operator)

16. Disconnect bonding cable from the aircraft, and stow it away. (nozzle operator)

17. Disconnect Earth ground from the aircraft, and stow away to its proper position (nozzle operator and refueling point operator)

18. Stow the hose, and return the nozzle to its proper position. (nozzle operator and refueling point operator)

19. Complete paperwork. (refueling point operators)

20. When necessary, ordnance personnel will arm aircraft accordingly.

21. Once aircraft have been refueled and armed, the aircrew should contact FARP OIC/Air Boss prior to departure.

22. Aircraft will then be cleared to depart refueling/ landing points.

18.12.4.6 Refueling Aircraft with Auxiliary Power Unit (APU) Running. The aircraft APU may be used to supply electrical power for pressure refueling on military aircraft in the FARP. This operation is not considered "hot refueling"; however, the following precautions shall be observed in addition to the previous procedures.

1. One crewmember shall be located at the GTC controls within the cockpit.

2. The individual manning the required firefighting equipment shall maintain visual contact with the crewmember at the controls. When the individual manning the firefighting equipment is unable to maintain visual contact with the crewmember at the controls, an additional individual from the local fuels organization shall take position so that he has visual contact with both the crewmember at the controls and the individual manning the firefighting equipment.

18.12.5 Fueling with Engines Operating (Hot Refueling). Hot refueling shall be performed only when operational requirements dictate the need for rapid turnaround of aircraft. The hot refueling of aircraft with ordnance requires a greater effort of coordination and is significantly more dangerous, in terms of fuel and ordnance and more costly in terms of manpower

expenditures, as compared to cold refueling. However, the operational gain can be significant. Hot refueling shall be performed only with the SPR or CCR nozzles.

WARNING

Open-port (gravity nozzle) hot refueling is NOT authorized.

18.12.5.1 FARP Hot Refueling Sequence of Events

1. All aircraft enter FARP and land in prestage area.
2. Aircraft are dearmed in the prestage area.
3. Aircraft taxi to the refueling point(s).
4. Aircraft are refueled.
5. Aircraft taxi to the post-stage area where they are armed or uploaded as required.
6. Aircraft are rearmed.
7. Aircraft depart FARP.

WARNING

Aircraft should avoid overflying other aircraft in the FARP to minimize potential for aircraft mishaps.

CAUTION

Prior to aircraft departure, communication should be reestablished between aircraft and FARP OIC/Air Boss for clearance to depart the FARP.

18.12.5.2 Initial Hot Refueling Procedures. The following steps shall be accomplished prior to aircraft entering the hot refueling area.

WARNING

Brown-out conditions adversely decrease the safety of flight in the FARP. All precautionary measures should be taken to increase safety-of-flight.

1. Recirculate (flush) the system or mobile refueler's hoses, and take a fuel sample for quality control checks as appropriate. (refueling point operator)

WARNING

- Fuel shall be recirculated/flushed through the refueling hose and nozzle, and tested for contamination prior to issuing fuel each day. Fueling shall not begin until acceptable results have been obtained (see Chapter 15). Failure to provide clean, dry fuel can adversely affect safety-of-flight.

- No nozzle sample shall be taken after the aircraft has taxied into the designated hot refueling area. Sampling increases the possibility of a fuel spill in the presence of an ignition source.

2. The area shall be policed for foreign object debris (FOD) when feasible.
3. Verify that appropriate firefighting equipment is in the FARP.
4. Ensure that all visual landing aids (e.g., panel markers, NVG-compatible lighting) are securely anchored/attached to the ground at the landing points. For required lighting configuration, refer to NAVAIR 00-80T-115.
5. Ensure that adequate spacing has been established between the prestage/post-stage and the refueling points (see Figures 18-2 to 18-4).

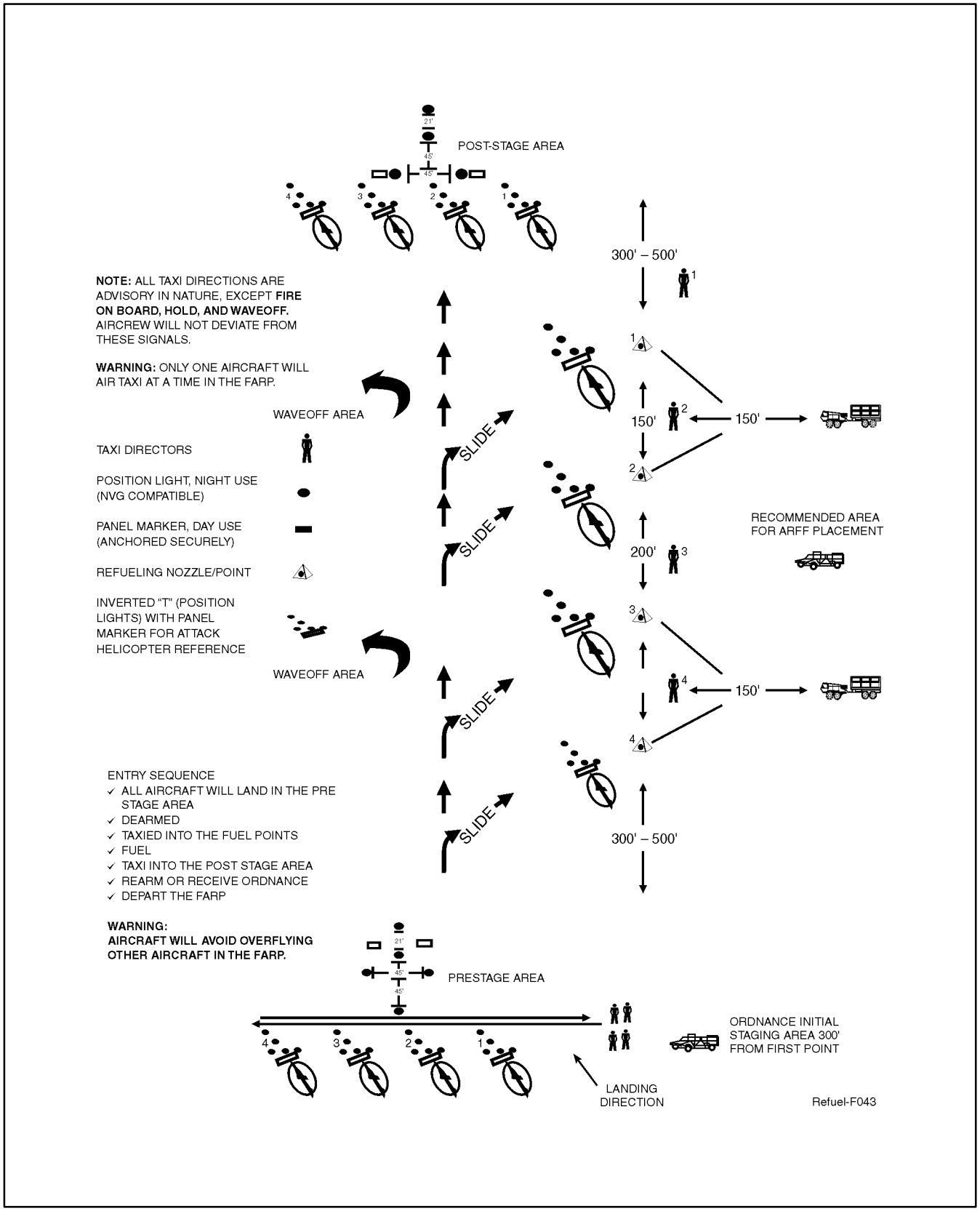
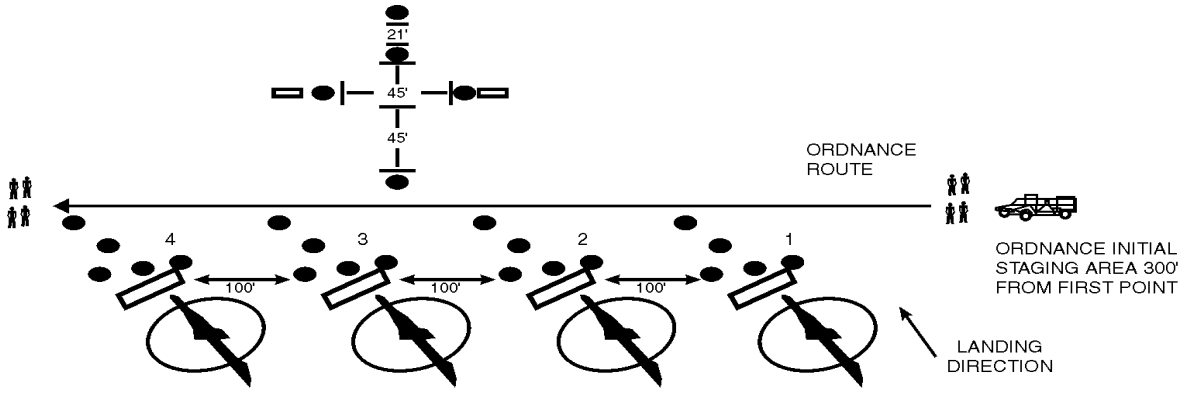


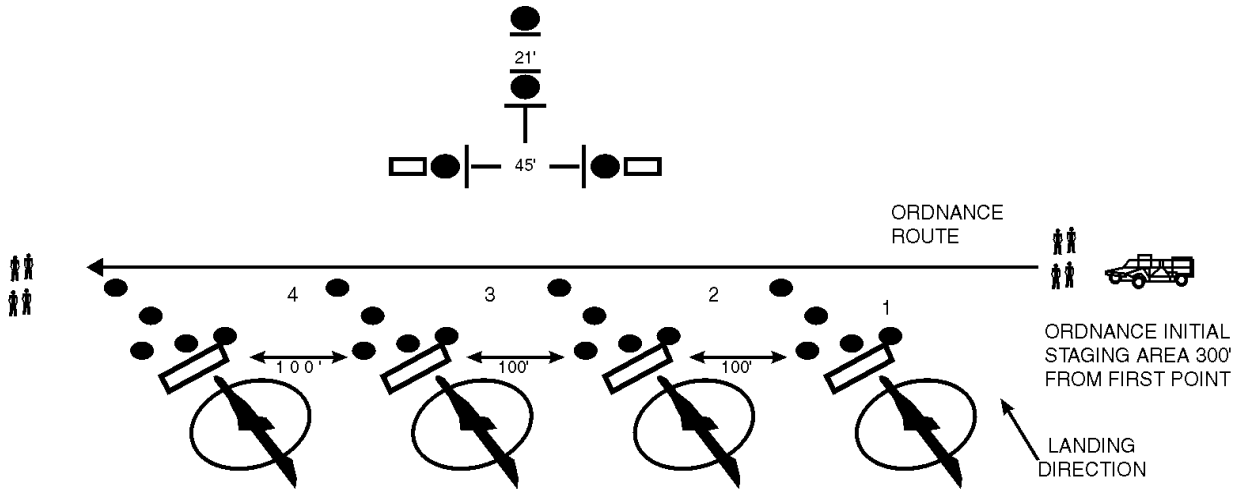
Figure 18-2. Four-Point FARP (Hot with Ordnance On-Board)



- ✓ All aircraft will land in the prestage area.
- ✓ The pre stage area will have marked positions one to four from the right to left.
- ✓ All aircraft will land from right to left, one to four.
- ✓ Ordnance personnel will dearm all aircraft from right to left starting at point one.
- ✓ Dearming shall start when ordnance personnel determine it is safe to do so.
- ✓ At a minimum, ordnance personnel must wait until all aircraft adjacent to the desired aircraft have landed and are at a flat pitch. (To dearm aircraft at point one, point two must be landed and at a flat pitch; to dearm point two, aircraft at point three must be landed and at a flat pitch, to dearm three the aircraft at point four must be landed and at a flat pitch).
- ✓ The aircraft at point one is clear to signal the taxi director to enter fuel area once ordnance personnel begin dearming the aircraft at point three. When ordnance personnel have cleared point three and moved to point four, point two can signal to the taxi director to enter the fuel area. The aircraft at point three can signal to enter the fuel area when ordnance personnel have completed dearming and are adjacent to the aircraft at point four.
- ✓ In case of malfunction (e.g., jammed gun), the troubled aircraft will be the first aircraft to taxi past through the FARP and proceed directly to point one in the post stage area for ordnance personnel to clear problem.
- ✓ Once cleared, the aircraft will depart the FARP and reenter the prestage area.

Refuel-F044

Figure 18-3. Hot Refueling with Ordnance Prestage Layout



- ✓ The same landing/ordnance procedures apply for rearming the aircraft in the post stage area, except ordnance crew will not return to their initial position. Ordnance crew will remain adjacent to point four.
- ✓ If uploads are required aircraft will taxi to its designated point and shut down.
- ✓ Once A/C is reloaded with ordnance and personnel/equipment are clear, aircraft are cleared to start engines, rearm and depart the FARP when ready.

Refuel-F045

Figure 18-4. Hot Refueling with Ordnance Post-Stage Layout

WARNING

At no time will an aircraft with forward firing ordnance land or change direction so the nose is pointed toward personnel or equipment. (See Figure 18-4 for landing direction.)

Note

Attack/utility spacing in the prestaging and post-staging areas will be a minimum of 100 feet apart and marked with visual landing aids (see Figures 18-2 to 18-4).

18.12.5.3 Aircraft Entry and Procedures. Once the aircraft have been determined ready for entry into the hot refueling area, the following steps shall be performed.

1. All aircraft will land in the prestage area and be dearmed. Aircraft with aircrews and no forward firing ordnance will dearm AN/ALE units (chaff and flare dispensers) and ensure crew served weapons are clear. Qualified ordnance personnel positioned in the prestage area must dearm aircraft with explosive ordnance or without aircrews. Aircraft will then taxi to the fuel point, refuel, taxi out to the post-stage area, and rearm.

2. Assault aircraft shall enter the fuel area by hover taxi with a 45° angle slide-in with the refueling receptacle on the side of the aircraft nearest the refueling hose/nozzle. All aircraft will land/position themselves abeam of the forward most open refueling point (see Figure 18-5). Attack/utility aircraft will land/position themselves abeam of the refueling point (nose pointed slightly outboard so no forward firing ordnance is pointing at other aircraft or FARP personnel/equipment). (See Figure 18-2.) Main rotors shall not overlap any fueling equipment in the refueling area. The integration of attack/utility aircraft (no forward firing ordnance) with assault aircraft is authorized. Aircraft will taxi parallel to the refueling points, and they will execute a 90° pedal turn to expose the refueling port to the fuel point (see Figure 18-6).

WARNING

- To minimize taxiing hazards, taxi directors shall be used. Taxi directors shall wear safety vests.
- Only one aircraft will hover/air taxi at a time in the FARP.

3. Prior to entry/exiting of the FARP, aircraft shall signal to the taxi director through the use of its anti-collision lights or other pre-arranged signal that they are prepared to enter/exit the FARP.

4. The taxi director shall then acknowledge the aircraft's signal through the use of hand and arm signals.

5. Once taxiing from point to point is completed, aircraft should turn off its lights.

WARNING

Taxi directors shall remain clear and cognizant of tail rotor-equipped aircraft operating on adjacent points.

18.12.5.4 Ordnance Procedures

1. Once aircraft land in the prestage area, qualified ordnance personnel shall verify all ordnance is safe prior to taxiing to the fuel point. Safe ordnance is defined as the repositioning of any mechanical arming lever(s), and or replacement of safety pin, electrical interrupt plug/pin, securing of armament switches, and/or appropriate action that renders the particular ordnance carried as safe.

Note

In the case of a malfunction (e.g., jammed gun), it will be the first aircraft to taxi past the FARP and proceed directly into point one of the post-stage area to be cleared. Once cleared, the aircraft will depart the FARP and reenter the prestage area.

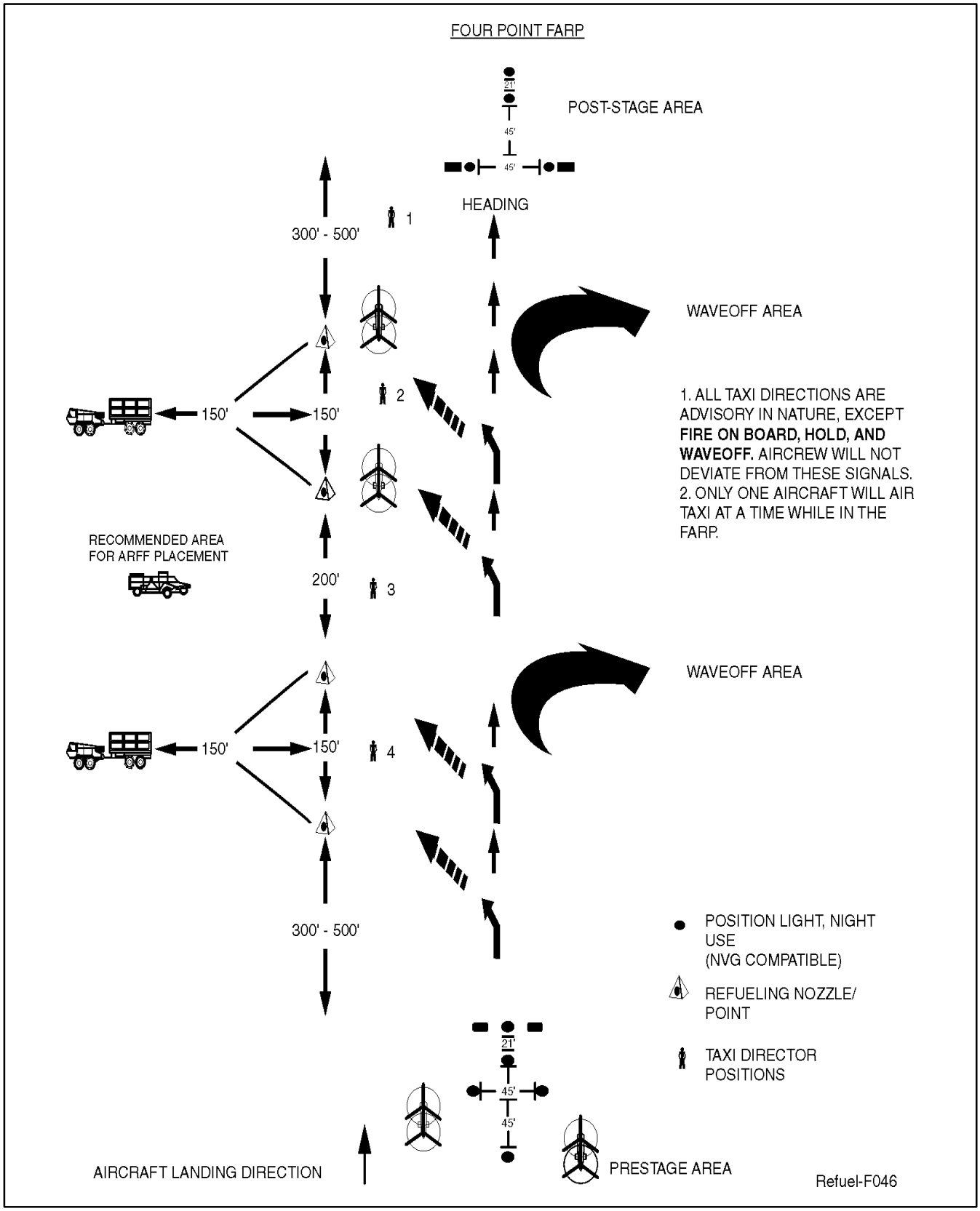


Figure 18-5. Standard Assault Hot FARP

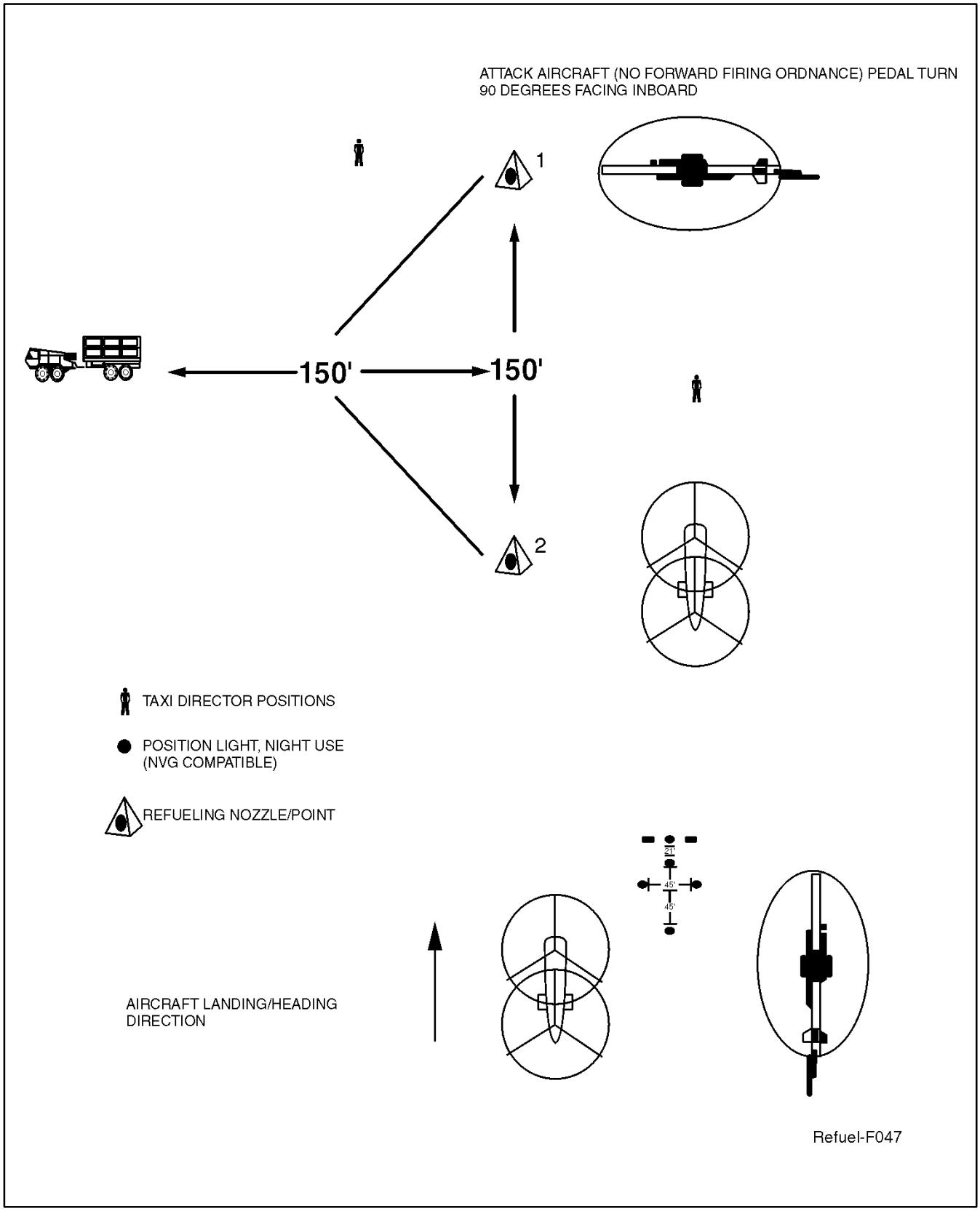


Figure 18-6. Integrated Assault/Attack Hot FARP

2. For attack/utility FARPs, the prestage area will have marked positions with a minimum of 100 feet separation, marked one to four from right to left (see Figure 18-4).

Note

The pre- and post-staging area will be located 300 to 500 feet from the nearest refueling point.

WARNING

The initial staging area for all ordnance personnel and equipment will be a minimum of 300 feet from first landing point. Ordnance personnel shall travel right to left on a designated route while arming/dearming aircraft in the pre- and post-staging areas (see Figures 18-2 to 18-4).

3. Aircraft shall land from right to left at points one to four.

4. Ordnance crew shall dearm all aircraft from right to left starting at point one.

WARNING

Dearming can start when ordnance personnel determine it safe, but at minimum, must wait until all aircraft adjacent to the desired aircraft have landed and at flat pitch. (To dearm aircraft at point one, the aircraft at point two must be landed and at a flat pitch; to dearm point two, the aircraft at point three must be landed and at a flat pitch; and to dearm point three, the aircraft at point four must be landed and at a flat pitch.)

5. Aircraft at point one is clear to signal the taxi director to enter the fuel area once the ordnance personnel begin dearming the aircraft at point three. When ordnance personnel have cleared point three, and have moved to point four, point two can signal to the taxi director to enter the fuel area. The aircraft at point three can signal to enter the fuel area when ordnance personnel have completed dearming and are adjacent to the aircraft at point four.

6. All hazards of electromagnetic radiation to ordnance (HERO) and high frequency (HF) procedures will be strictly adhered to in accordance with applicable NATOPS manuals.

WARNING

Uploading/downloading of ordnance during refueling operations is prohibited.

18.12.5.5 Hot Refueling Procedures. These procedures apply to both stationary and mobile equipment.

WARNING

Personnel onboard not essential to the mechanical function or operation of the aircraft will disembark at the fuel points and prior to refueling. A safe point will be established to muster personnel. Personnel will re-embark prior to the rearming operation.

1. Crew changes and hot seating shall not occur during actual fueling, dearming, or arming of the aircraft.

WARNING

- The refueling hose shall not pass underneath or around the back of the aircraft to reach the SPR receptacle.

- Rear cargo doors/windows and/or doors/windows on opposite side of aircraft from the refueling receptacle may be open provided the refueling hose is positioned so that it is unlikely fuel sprays from nozzle adapter malfunction or hose rupture will enter aircraft passenger/cargo/cockpit compartment(s).

WARNING

- Assume all engines on multi-engine aircraft are operating.
- No engine will be restarted within 50 feet of any fuel handling equipment.

2. Pilot shall secure all unnecessary electronic and electrical equipment in accordance with respective aircraft NATOPS Manual.

WARNING

Once a fueling evolution has commenced, the aircraft's electrical power status and connections shall not be changed until the refueling evolution has been completed or refueling has been stopped for an emergency (i.e., NO aircraft engines or APU shall be started or stopped and external power shall NOT be connected, disconnected, or switched on/off). Changing the aircraft's electrical power status can create significant ignition sources.

3. Ensure that firefighting equipment is in the immediate area of the refueling operation and manned for rapid response. (refueling point operator)

4. Attach a grounding cable from an established Earth ground to the aircraft. (refueling point operator)

5. Zero the fueling system's meter or note the existing reading. (refueling point operator)

6. Pull out the refueling hose and hand the nozzle to the nozzle operator. (refueling point operator)

7. Remove refueling adapter cap from the aircraft and the dust cover from the nozzle. Inspect the face of the nozzle to ensure it is clean, and verify that the flow control handle is in the fully closed and locked position. (nozzle operator/refueling point operator)

8. Visually inspect the aircraft's adapter (receptacle) for any damage or significant wear. If any doubt about the integrity of the adapter exists, do not refuel.

WARNING

A worn or broken adapter can defeat the purpose of the safety interlocks of the refueling nozzle, permitting the poppet valve to open and fuel to spray or spill.

9. Ensure the nozzle bonding plug/clamp is connected/attached to aircraft prior to nozzle hookup. (nozzle operator)

10. Lift nozzle by lifting handles, align the lugs with the slots on the aircraft adapter, and hook up to the aircraft by pressing it firmly onto the adapter and rotating clockwise to a positive stop. (nozzle operator)

WARNING

Nozzle must seat on the adapter and not be cocked. Cocking can indicate a malfunction of the nozzle's safety interlock system, which can lead to a fuel spray or spill.

11. Rotate the nozzle flow control handle to the FULL OPEN position. The handle shall rotate 180° to ensure that the poppet valve is fully open and locked. (nozzle operator)

WARNING

The flow control handle of the single point pressure refueling nozzle shall be placed in either of two locked positions — fully open or fully closed. The handle is NOT to be used as a flag to indicate fuel flow. Excessive wear on the aircraft's adapter and the fuel nozzle poppet will result if the handle is allowed to float in the unlocked position.

12. Upon receiving signals from nozzle operator that hook-up has been completed and fueling

operation is ready to begin, refueling point operator signals the pump operator to charge the system, allowing fuel to flow to the nozzle.

WARNING

- Deadman controls, where provided, shall not be blocked open or otherwise inhibited. This defeats the purpose of the device and can lead to a catastrophic accident.

- Discontinue refueling immediately if any leaks are discovered throughout the operation. All repairs/maintenance will be performed away from the aircraft to avoid mishap in the event of a leak or hose rupture, etc.

13. Fuel aircraft as directed by nozzle operator. Nozzle operator shall monitor aircraft vents, tank pressure gauge(s), and/or warning lights as necessary.

14. When directed by the nozzle operator/refueling point operator, stop the flow of fuel by using the deadman control if so equipped. (refueling pump operator)

15. Rotate the nozzle flow control handle into the OFF and fully locked position. (nozzle operator and verified by the refueling system operator).

WARNING

Failure to lock the flow control handle in the OFF position can contribute to a failure of the nozzle's safety interlock system and could result in a fuel spray or spill.

16. Disconnect nozzle from the aircraft adapter. (nozzle operator)

17. Disconnect the bonding cable from the aircraft. (nozzle operator)

18. Disconnect the Earth ground from the aircraft and stow away to its proper position. (nozzle operator and/or refueling system operator).

19. Replace the dust cover, stow hose, and return the nozzle to its proper position. (nozzle operator and refueling system operator).

20. Complete paperwork. (refueling point operators).

18.12.5.6 Aircraft Exiting Procedure

1. Once the aircraft is fueled and nozzle is stowed, aircraft will leave the fuel point under the guidance of the taxi director in the order they came into the refueling points.

2. Aircraft will exit the fuel points one at a time and land in the post-stage to arm or upload as required.

3. The same landing/ordnance procedures apply for rearming aircraft in the post-stage area (arming from right to left starting at point one). Ordnance crew shall remain adjacent to point four. (See Figure 18-4.)

4. If uploads are required aircraft will shut down.

5. Once aircraft are loaded with ordnance and personnel/equipment are clear, aircraft can start engines, rearm and depart the FARP when ready.

Note

Holding in the post-stage area will be at the discretion of the aircraft commander or flight leader.

CHAPTER 19

Maintenance of Tactical Fueling Equipment

19.1 GENERAL REQUIREMENTS

The maintenance and inventory of the Marine Corps tactical/deployable refueling assets shall be accomplished in accordance with current MCO P4790.2 series, TM 3835-10/1, other governing directives, and this chapter. Adherence to preventive checks and services is critical.

19.2 AIRCRAFT REFUELING EQUIPMENT CHECKLISTS

Each unit shall use daily, weekly, monthly, and periodic checklists similar to those contained in Figures 13-1 through 13-4. Locally developed checklists or checklists that are published in accordance with current technical manuals that are specific to individual systems may be substituted.

19.3 DAILY CHECKLIST

The daily checklist shall be completed on all aircraft fuel delivery equipment that is in continuous use, once in every 24-hour period on a not-to-interfere-with-aircraft-servicing basis.

WARNING

Equipment that fails to meet established requirements shall be removed from service until corrective action has been completed.

The following detailed discussions pertain to the serially numbered items in Figure 13-1, Daily Checklist.

1. Fire Extinguishers. Report discrepancies immediately and do not use the equipment until certified.

2. Inspect nozzle for damage; check node seal for cracks or nicks, outer shell for tightness to top connection, safety wire on lock bolt, handles for tightness, and flow control handle for excessive wear, cracks, or breaks.

3. Hook up nozzle to bottom-loading adapter or recirculation fitting and inspect the entire nozzle assembly for broken, cracked parts, or evidence of leaks.

   a. Aircraft refueling nozzles shall be stored with their dust covers in place.

   b. On mobile refuelers, nozzles shall be stowed to prevent them from falling or dragging from the vehicle in motion. At no time will nozzles be allowed to extend beyond the extremities of the unit while in transit. Nozzle storage shall provide protection from the environment and in particular, the nozzle face seal and poppet areas to prevent their damage and contamination. Special attention shall be placed on the positioning of nozzles in storage to ensure that accumulation of dirt and water is minimized.

Note

When nozzles are allowed to hang inverted, exposed to the environment, water and dirt may build up in bearing collar and nose seal areas.

4. Inspect the entire length of the hose thoroughly. Special emphasis should be placed on the area close to the nozzle and near the connection at the opposite end where the hose should be pressed and tested for soft spots around the entire circumference. Be alert for blisters and wet spots. Any exposed hose reinforcement material is cause for hose replacement because exposed fabric provides a source for water to enter, migrate, and ultimately rot the fabric. Inspect the area around hose end couplings for slippage (evidenced by misalignment of hose end couplings and/or scored or exposed areas). All hoses, whether in service or in reserve, shall be stored as follows:

   a. Store all hoses in a manner that prevents twists, sharp bends, or kinks.

b. Protect hoses, not used daily, from the sun in order to reduce ultraviolet deterioration.

c. Cover both ends to prevent damage to coupler and the introduction of contaminants.

d. Store hoses off the ground to prevent the collection of water and dirt.

5. Bonding cables shall be in place and in good condition, clean, and with serviceable plugs and clips securely attached. If grounding cables are used, a similar check should be made.

6. Carefully inspect tanks, hoses, valves, pumps, meters, separators, and couplings for leaks. If any leaks are found, record the location and immediately "down" the equipment. Equipment shall not be used until repaired.

7. Check emergency valve controls (if present) for condition and ease of operation. If air-operated, build up system pressure and check operation of the controls. Keep emergency valve closed at all times except when delivering fuel or circulating product.

8. Exterior surfaces should be wiped clean of oil, grease, and fuel. Ensure that cabinets, troughs, cabs, and any enclosure are free of fuel, dirt, cleaning material, and unnecessary items. Check fenders and mudguards to ensure adequate protection against throwing of mud and dirt on fueling equipment and rear of unit.

9. Check the fluid levels of the battery, radiator, gas, and engine oil.

10. Ensure that lights are operable, all electrical wiring outside of cab is enclosed in tubing, and rear-view mirrors are serviceable.

11. With equipment in level position, drain product from the manual low point drain of the tank into a clean container. If water is found, empty sample into salvage container and repeat the process until a clean, water-free sample is obtained.

    a. Open the filter/separator manual drain valve and drain off all water. After all water has been drained, draw approximately 1 pint of fuel into a clean container and visually inspect for water. Repeat as necessary until only clean, bright fuel is obtained. A low-point drain sample should also be taken from the fuel monitor housing, if separate from the filter/separator housing, and inspected for water and particulates. Again, repeat until only clean, bright fuel is obtained.

12. Carefully inspect the exhaust pipe and muffler system(s), including any auxiliary engine system, for leaks, cracks, noise, and proper placement. Ensure that clean-out port in spark arrestor is covered. Flex piping is not authorized.

13. Check the emergency brakes to ensure there is plenty of throw on the emergency brake handle and the emergency brake valve to ensure trailer brakes (M970) are operational and will hold.

WARNING

Never operate tactical refueler with the brakes "caged." This allows for the by-passing of the air brake system of the M970 refueler.

14. Drain air tanks of moisture and check for fuel contamination. Malfunctioning air-operated valves that control fuel flow and check valves have been cited as causes for fuel entering brake air systems. The smell of fuel or fuel droplets in the air being bled off is cause for immediately "downing" the equipment until the problem is resolved. The most common source of fuel or fuel vapors in the air system is the rupture or cracking of a diaphragm in the fuel flow control valve. In addition, corrosion resulting from moisture in the air system can cause one-way check valves to remain open thus, allowing fuel into the system.

15. Engage the pump and pressurize the systems. Check entire system for leaks. The maximum allowable circulation time for refuelers, less than 1/2 full, is 3 minutes. Hose inspections, in item number 4 above, should be conducted during circulation. Check to see if fuel is leaking from the vent port on the hose end pressure regulator. If fuel

is leaking from this port, remove the hose end pressure regulator from service and repair it.

WARNING

- Equipment that fails to meet the established requirements shall be removed from service until corrective action has been completed.

- The vent port on the hose end regulator must never be plugged since it is critical to proper operation.

16. Place the nozzle's flow control handle to the fully opened and locked position and circulate fuel. Circulation is to be performed through either the bottom loader or recirculation receptacle on the same or another unit. (An adapter is necessary for over-wing nozzles.) On refueling trucks, circulation is to be performed at standard rpm settings where flow rates can be measured and differential pressure readings are meaningful. Circulation of trucks must be limited to a period of 10 minutes, each followed by a 1-minute rest period to allow electrostatic charges to dissipate. All equipment must be circulated for a time period that is sufficient to flush out all piping downstream of the fuel monitor elements.

17. Check operation of the pump. Listen for unusual sounds and feel for overheating and/or abnormal vibrations.

18. During recirculation, observe the pressure indicator located on the filter and the monitor. The daily pressure drops across each filter/separator and fuel monitor should be recorded in a special log or on the daily checklist.

WARNING

It is essential that differential pressure readings be made only when the system is operating at standard conditions since the accuracy of the differential readings is directly dependent on the system's overall flow and pressure conditions. Use of non-standard, variable operating conditions causes meaningless results and will prevent the identification of filter or monitor element failures.

APPENDIX A

Aviation Fuel Quality Surveillance Logs and Labels

AVIATION FUEL QUALITY SURVEILLANCE LOG

CCFD Serial No.	Sample		Date Tested	Sample Serial No.	Source of Sample	Test Performed					Test Results	Testers Initials
	Date	Time				VIS	CFD	FWD	API	FSII		

Figure A-1. Aviation Fuel Quality Surveillance Log

AVIATION FUEL CONTAMINATION FUEL DETECTOR CORRELATION LOG

CCFD Serial Number:				Location:			
Sample		Date Tested	Sample Serial No.	Source of Sample	Test Performed	Test Results	Difference*
Date	Time						
					In-house CFD		
					ASTM D 2276		
					In-house CFD		
					ASTM D 2276		
					In-house CFD		
					ASTM D 2276		
					In-house CFD		
					ASTM D 2276		
					In-house CFD		
					ASTM D 2276		
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					In-house CFD		
					ASTM D 2276		
					In-house CFD		
					ASTM D 2276		
					In-house CFD		
					ASTM D 2276		

*If the difference is greater than 0.8 mg/l, immediately notify supervisor/manager.

Figure A-2. Aviation Fuel Contamination Fuel Detector Correlation Log

AVIATION FUEL B/2 TEST KIT (FSII) CORRELATION LOG

				Location:			
Sample		Date Tested	Sample Serial No.	Source of Sample	Test Performed	Test Results	Difference*
Date	Time						
					In-house FSII		
					Central Lab FSII		
					In-house FSII		
					Central Lab FSII		
					In-house FSII		
					Central Lab FSII		
					In-house FSII		
					Central Lab FSII		
					In-house FSII		
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					Central Lab FSII		
					In-house FSII		
					Central Lab FSII		

*If the difference is greater than 0.03 percentage points, immediately notify supervisor/manager.

Figure A-3. Aviation Fuel B/2 Test Kit (FSII) Correlation Log

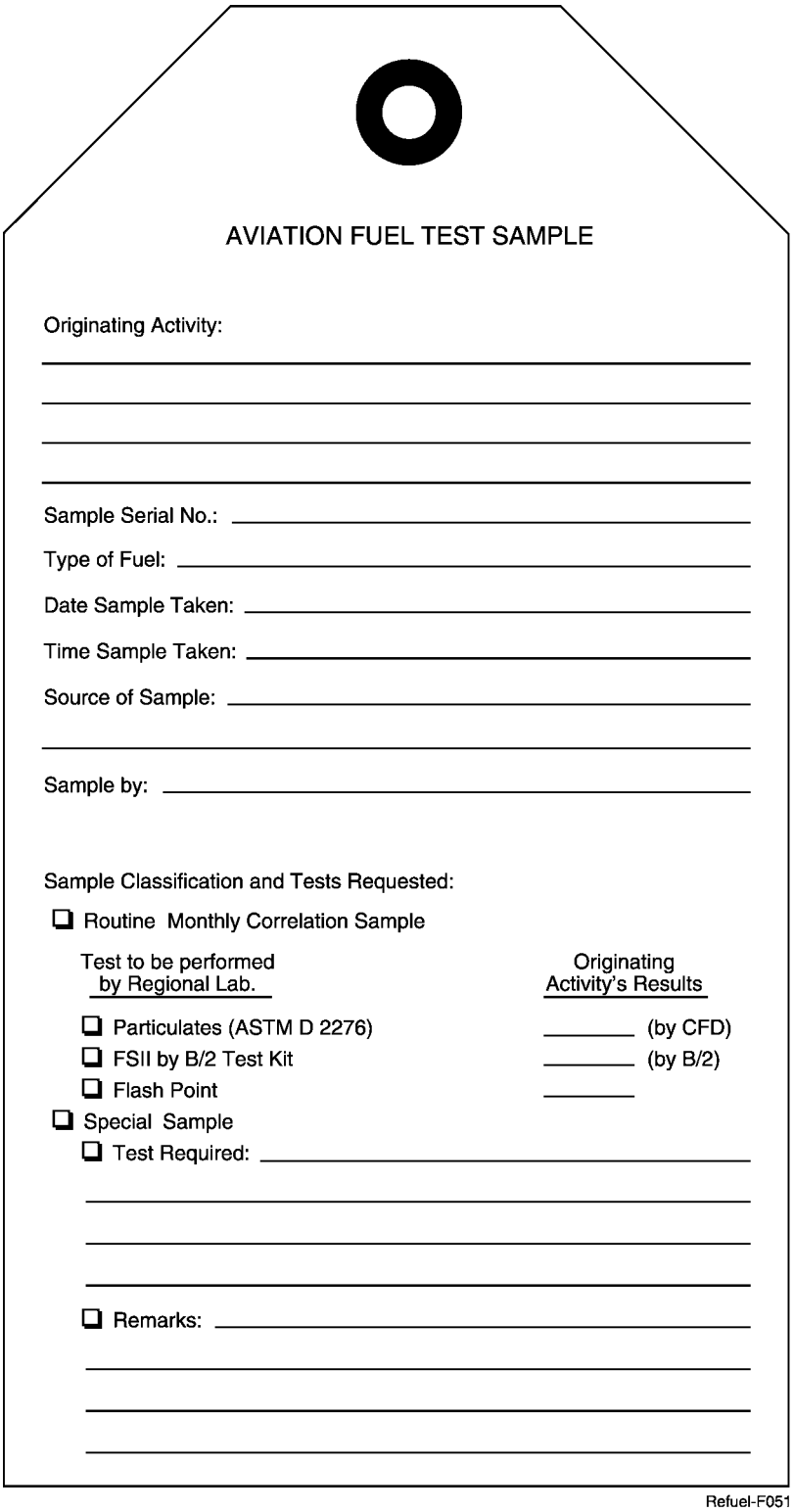

Figure A-4. Aviation Fuel Sample Label

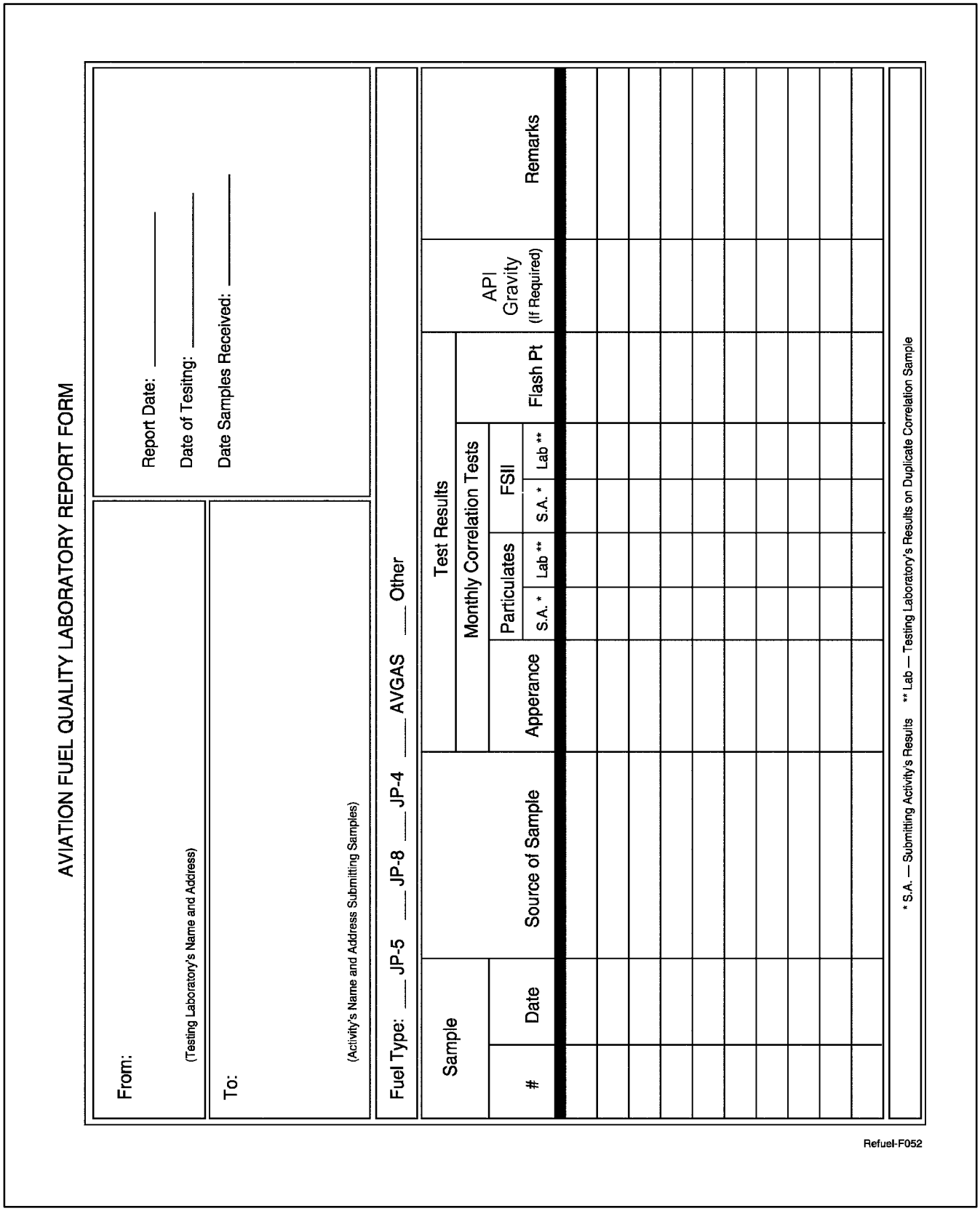

Figure A-5. Testing Laboratory Aviation Fuel Result Report Form

QUALITY ASSURANCE FUEL SAMPLE LOG

PAGE # _____ OF _____ DATE _____

CCFD SERIAL #	SERIAL #	TIME TAKEN	LAB ARRIVAL TIME	LOCATION SAMPLE	VISUAL APPEARANCE	TIME WATER RAN	RPM	TIME SEDIMENT RAN	1ST	2ND	FINAL READING	F/P	FSII	API	S/G	OPERATORS SIGNATURE

Refuel-F053

SUPERVISOR _____ CPO _____ MAINTENANCE OFFICER _____

Figure A-6. Shipboard Fuel Sample Log

FILTER SAMPLE / PRESSURE DROP LOG

FILTER _____

PAGE # _____ OF _____ DATE _____

TIME	INLET PRESSURE	DIFF PRESSURE	DISCH PRESSURE	SUMP SAMPLE	VISUAL DISCH SAMPLE	LAB RESULTS	TANK #	OPERATORS SIGNATURE

NOTE: SAMPLES SHALL BE TAKEN IAW OSS.

Refuel-F054

SUPERVISOR _____ CPO _____ MAINTENANCE OFFICER _____

Figure A-7. Shipboard Filter Sample/Pressure Drop Log

EQUIPMENT RUNNING LOG

EQUIPMENT_____

PAGE #_____ OF _____ DATE _____

START TIME	STOP TIME	TOTAL TIME	FROM	TO	INLET PRESS	DISCH PRESS	FILTER #	CONTAM/ DEFUEL TANK	RESULTS VISUAL SAMPLE	RESULTS LAB SAMPLE

Refuel-F055

TOTAL RUN TIME THIS PAGE: _____

SUPERVISOR _____ B/D CPO _____ MAINTENANCE OFFICER_____

Figure A-8. Shipboard Fuel Sample Log

APPENDIX B

Aviation Fuel Deterioration Use Limits

PROPERTY	SPECIFICATION REQUIREMENT	USE LIMIT[1]	ASTM TEST METHOD
ALL TURBINE FUELS (JP-5, JP-8, JP-4)			
Existent Gum, mg/100 ml, max	7	14	D 381
Corrosion, Copper Strip, 2 hours at 100 °C (212 °F), max	1	Note 2	D 130
Lead Content, mg/l, max	Not Specified	14.0	D 3116
Particulate Matter, mg/l, max	1.0	2.0	D 2276 or CFD
Distillation Residue, % max, V/V	1.5	2.0	D 86
FSII, % Volume	0.10 – 0.20	0.07 – 0.20[3]	D 5006[4]
JP-5, NATO Code F-44			
Flash Point °C (°F), min	60 (140)	60 (140)[5]	D 93
API Gravity, °APL, min – max	36.0 – 48.0	36.0 – 48.0	D 1298
Distillation, % fuel recovered at 205 °C (400 °F)	10	7	D 86
Peroxide number, ppm, max	8.0	16.0	D 3703
WSIM, min	Note 6	Note 7	D 3948
Filtration time, minutes, max	15	30[8]	Note 9
JP-8, NATO Code F-34			
Flash Point °C (°F), min	38 (100)	32 (90)	D 93
API Gravity, °APL, min – max	37.0 – 51.0	37.0 – 51.0	D 1298
WSIM, min	Note 10	Note 7	D 2550
Electrical Conductivity pS/m, allowable range	150 – 600	100 – 700	D 2624 or D 4308
Filtration time, minutes, max	15	20[8]	Note 9
JP-4, NATO Code F-40			
API Gravity, °APL, min – max	45.0 – 57.0	45.0 – 57.0	D 1298
RVP @ 37.8 °C kPa (psi @ 100 °F)	14.0 – 21.0 (2.0 – 3.0)	10.4 – 22.5 (1.5 – 3.2)	D 323 or D 2551
WSIM, min	Note 10	Note 7	D 3948
Electrical Conductivity pS/m, allowable range	150 – 600	100 – 700	D 2624 or D 4308
Filtration time, minutes, max	10	15[8]	Note 9

Deterioration Use Limits for Aviation Turbine Fuels (Specifications MIL-T-5624 and MIL-T-83133)

Notes	
1	All physical and chemical properties not listed must fully meet the requirements of MIL-T-5624 for JP-5 or JP-4 or MIL-T-83133 for JP-8.
2	Under certain conditions, NAVAIR may authorize the use of jet fuel having a corrosion rating of 2 or greater by not exceeding 3a. This depends on quantity involved, location and mission of aircraft, cause of corrosion, and evaluation of complete specification test data. Forward details to NAVAIR 4.4.5 for evaluation.
3	this use limit applies to UASF, U.S. Army, and NATO aircraft only. Only two U.S. Navy and Marine Corps aircraft need FSII and their minimum use limit is 0.03 volume percent. See discussion in text of Chapters 3 and 9 for more details.
4	Additional test methods for FSII content are the B/2 Anti-Icing Additive Refractometer and Test Kit and methods 5327 or 5340 of Federal Test Method Standard Number 791.
5	JP-5 must have a flash point of at least 140 °F for issuance to a naval ship or for defueling from an aircraft into a ship's storage system.
6	At the time of manufacture, the minimum water separation index, modified (WSIM), rating for JP-5 shall be 90 with only antioxidant and metal deactivator (if used) additives present, or 85 with all additives except the corrosion inhibitor/lubricity improver additive present, or 80 with all additives except the fuel system icing inhibitor present, or 70 with all additives present.
7	NAVAIR considers WSIM to be a refinery check on the relative cleanliness of all turbine fuels with regard to surfactant materials which may disarm filter/separators. Once all required additives have been injected into JP-5, JP-4, and JP-8, the WSIM often drops below 70. It is not a reliable method for determining whether a fuel has picked up any surfactant materials during transport and storage within the supply/distribution network. NAVAIR, therefore, does not impose a use limit for WSIM on fuels once they have left the refinery.
8	Under certain conditions, NAVAIR may authorize the use of jet fuel having filtration times in excess of 30 minutes; however, it must be noted that high filtration time fuel will significantly reduce the life of filter/separators and fuel monitors. The pressure drops across these filters must be monitored frequently whenever high filtration time fuel is encountered.
9	A minimum sample size of one gallon shall be filtered. Filtration time will be determined in accordance with the procedure in Appendix A of MIL-T-5624.
10	The minimum WSIM rating for JP-4 and JP-8 shall be 85 with all additives except corrosion inhibitor/lubricity improver additive and static dissipater additive present or 70 with all additives present except for the static dissipater additive.

Deterioration Use Limits for Aviation Turbine Fuels (Specifications MIL-T-5624 and MIL-T-83133)

APPENDIX C

Aviation Fuel Division Continuing Training Syllabus

1. Catapult lube oil system
   a. Introduction to system
   b. Catapult lube oil tanks
   c. Fill/transfer piping and procedures
   d. Catapult lube oil valve
   e. Pumps and strainers
   f. Fill/transfer procedures.
2. Hazards
   a. MOGAS characteristics and precautions
   b. JP-5 characteristics and precautions
   c. Pollution prevention.
3. JP-5 system
   a. JP-5 tanks
   b. Tank level indicators
   c. Transfer system
   d. Stripping system and operating procedures
   e. Service system and operating procedures
   f. Auxiliary system and operating procedures
   g. Control console operation (CVN-68 Class)
   h. Limitorque valves: Operations and maintenance (CVN-68 Class)
   i. Replenishment procedures
   j. Settling and stripping procedures
   k. Rotary vane pumps
   l. Centrifugal pumps
   m. Tank cleaning procedures
   n. Tank sounding procedures
   o. Jet engine test system
   p. Filter separators
   q. Pump/filter room ventilation system
   r. Reclamation system
   s. Emergency evacuation of spaces
   t. Ballasting/deballasting JP-5 stowage tanks
   u. Centrifugal purifiers.
4. Aircraft refueling equipment and procedures
   a. Aviation refueling station description
   b. CV Flight/Hangar NATOPS 00-80T-120 (Aircraft Fuels Sections)
   c. Aircraft refueling/defueling procedures and safety precautions
   d. Refueling station operation
   e. Refueling nozzles and probe adapters
   f. NAVAIR 00-80T-109 (Aircraft Refueling NATOPS Manual)
   g. MIL-HDBK-844(AS) (Aircraft Refueling Handbook)
   h. Fueling station continuity system
   i. Portable defueling pump

j. Hot refueling procedures

k. Flight/hangar deck emergency procedures

l. NAVAIR 00-80T-113 (Aircraft Signals NATOPS Manual).

5. Aviation fuels equipment repair

a. Repair party organization

b. Use/care of hand and measuring tools

c. Aircraft refueling nozzle maintenance

d. JP-5 defueling pumps

e. Patching/plugging aviation fuels piping

f. In-port and underway replenishment

g. Aviation fuels station ventilation

h. Aviation fuels maintenance safety precautions

i. Fuel hose repair

j. CLA-VAL maintenance.

6. Aviation fuels quality surveillance

a. Maintaining quality of aviation fuels

b. Operation/maintenance of AEL MK I/II Free Water Detector

c. Operation, calibration and maintenance of Combined Contaminated Fuel Detector (CCFD)

d. Operation/maintenance of NAVIFLASH

e. API gravity testing

f. B-2 anti icing test kit (FSII testing)

g. Aviation fuel sampling, testing and reporting

h. Operation/maintenance of Pensky-Martin flash point tester

i. Aviation fuel sampling/testing safety

j. In-port/underway replenishment fuel quality standards and testing.

7. Pump/filter room firefighting equipment

a. CO-2 fixed flood system and portable extinguishers

b. PKP dry chemical extinguishers

c. Bilge sprinkler system

d. Aqueous Film Forming Foam (AFFF) system.

Index

A

B

C

D

E

F

G

H

I

L

M

N

O

P

Q

R

S

T

U

W

LIST OF EFFECTIVE PAGES

Effective Pages	Page Numbers
Original	1 (Reverse Blank)
Original	3 (Reverse Blank)
Original	5 (Reverse Blank)
Original	7 (Reverse Blank)
Original	9 (Reverse Blank)
Original	11 thru 21 (Reverse Blank)
Original	23 thru 31 (Reverse Blank)
Original	1-1 thru 1-2
Original	2-1 (Reverse Blank)
Original	3-1 thru 3-10
Original	4-1 thru 4-4
Original	5-1 thru 5-6
Original	6-1 thru 6-16
Original	7-1 (Reverse Blank)
Original	8-1 thru 8-4
Original	9-1 thru 9-12
Original	10-1 thru 10-4
Original	11-1 thru 11-16
Original	12-1 thru 12-32
Original	13-1 thru 13-17 (Reverse Blank)
Original	14-1 thru 14-2
Original	15-1 thru 15-11 (Reverse Blank)
Original	16-1 thru 16-4
Original	17-1 thru 17-8
Original	18-1 thru 18-40
Original	19-1 thru 19-3 (Reverse Blank)
Original	A-1 thru A-9 (Reverse Blank)
Original	B-1 thru B-2
Original	C-1 thru C-2
Original	Index-1 thru Index-7 (Reverse Blank)
Original	LEP-1 (Reverse Blank)